# A quantitative comparisons of $\beta$ -coronavirus genomes and their associated genes

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#### Abstract

A precise understanding of the genes and associated genomes of SARS-CoV2 is important for various reasons such as discovering origin of the virus and virulence and so on. A thorough descriptive understanding of the SARS-CoV2 genomes and other coronavirus of the beta-coronavirus genus is primarily important. In this article, a set of ten genomes of four CoVs and their associated genes are considered for this present study. A spatial representations of nucleotide bases including purine-pyrimidine representations of the different genes of the corresponding genomes are quantified using Hurst exponent, Shannon entropy and density estimation of different nucleotides including GC content, in order to draw a comparison and contrast among the ten genomes of different types of CoVs which include MERS, SARS-CoV, HKU1 (Human Coronavirus) and associated their genes.

Keywords: COVID-19; Hurst exponent; Shannon entropy; Nucleotide Density; Purine-Pyrimidine representation.

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#### 1. Introduction

The coronavirus disease (COVID-19) is a highly transmittable viral infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV2), which is primarily emerged in Wuhan, China and accordingly it spreads over various countries and world has been experiencing the pandemic [1, 2, 3, 4, 5, 3]. The family of coronaviruses (CoVs) can be grouped into four different types such as  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  coronavirus [6, 7]. The SARS-CoV2 belongs to the  $\beta$ -CoV group [8]. The intermediate source of origin and transfer to humans is still unsettled although various claims have been published. However, the rapid human to human transfer has been confirmed widely [9]. It has been observed that the transmission rate of SARS-CoV2 is higher than SRAS-CoV and the reason could be genetic recombination event at S gene/protein in the RBD region of SARS-CoV2 may have enhanced its transmission ability [10]. It is reported earlier that the genome of the SARS-CoV2 has been reported over 76% identical to the previous SARS-CoV [11]. From the sequential similarity of SARS-CoV and SARS-CoV2 genomes, it has been seen that SARS-CoV-2 lies close to the group of SARS-CoVs in the evolutionary tree (phylogeny) [11]. It is also reported recently that notable variations in SARS-CoV and SARS-CoV-2 such as the absence of 8a protein and variations in the number of amino acids in 8b and 3c primary protein sequences in SARS-CoV2 [12].

The genome of coronaviruses contains approximately 26kb and 32kb nucleotides which represent a variable number (from 6 to 11) of open reading frames (ORFs) [13, 14, 15]. The ORF1 represents (67% of the genome) 16 non-structural proteins (nsps) and other ORFs encode accessory proteins and structural proteins [16]. A comprehensive comparison of genomes of coronaviruses must comprise all the ORFs (protein encoding frames). It has been observed by many researchers that the present SARS-CoV2 genomes have string simi-

larities with other CoVs of the  $\beta$ -CoV group such as middle east respiratory syndrome coronavirus (MERS-CoV) and human CoV (HKU1) [17, 18]. It is noticed that the only sequence based similarity does not illuminate actual difference (microscopic) among these genes and genomes. It only presents a qualitative understanding of the evolutionary connections. Therefore, we intend to discover the spatial arrangements of each nucleotide over the RNA genes and genomes using various mathematical methods. In this present study, a comprehensive comparison among the whole genomes and associated genes of SARS-CoV2, MERS, SARS-CoV-1, HKU1 (Human Coronavirus) is made, from the spatial and molecular organizations including different density estimations of nucleotides.

# 1.1. Dataset and Its Specifications

From the NCBI Virus Database (https://www.ncbi.nlm.nih.gov/labs/virus/vssi/) we took ten genomes and their associated genes of which the detailed list is given in the Table-1.

Name	Accession	Species	Length	${ m Geo}\_{ m Location}$
S1	NC_045512	SARS	29903	China
S2	MT012098	SARS	29854	India
S3	$NC_{-}038294$	MERS	30111	UK
S4	NC_006577	Human coronavirus HKU1	29926	Unknown
S5	KP143510	$lpha ext{-CoV-1}$	28967	UK
S6	KF923891	$\beta$ -CoV-1	30713	China
S7	MT126808	SARS	29876	$\operatorname{Brazil}$
S8	MT077125	SARS	29785	Italy
S9	MT292571	SARS	29782	Spain
S10	MT322402	SARS	29898	$\overline{\mathrm{USA}}$

Table 1: List of genomes and their associated information

Let G(i, j) denotes the  $j^{th}$  gene of the  $i^{th}$  genome Si as mentioned in the Table-1.

Our objective is to consider the above data is to determine spatial arrangement of nucleotide bases (A, T, C and G) and in the level of purine (A,G) and pyrimidine (C, T) bases of the genes and their associated whole genomes. We took here six SARS-CoV2 genomes and associated genes from six countries China, India, Brazil, Italy, Spain and USA. Another set of four genomes and their associated genes of MERS, HKU1, α-CoV-1 and β-CoV-1 types are considered in order to find similarities and dissimilarities.

We transform each genome Si and their corresponding genes G(i, j) in different binary forms as demonstrated in the following.

Firstly, we transform each sequence to a binary sequence of 1's and 0's as per the definition 2. Here purine (A,G) and pyrimidine (T,C) bases are represented as "1" and "0" respectively. This binary representation is named as purine-pyrimidine representation [19, 20, 21].

$$A/G \to 1$$

$$T/C \to 0$$
(1)

Also we transform each sequence to a binary sequence with respect to a nucleotide base B of 1's and 0's as per the following definition ??.

$$X \rightarrow 1$$
 if  $X = B$  
$$X \rightarrow 0$$
 if  $X \neq B$  (2)

Hence four binary representations for each nucleotide  $B \in \{A, T, C, G\}$  would be obtained for a given nucleotide sequence. These binary representations are actually the spatial template of each nucleotides. Each of these spatial templates are to be analysed using various means as mentioned in the following section.

## 2. Methods

Here some popular spatial features such as the amount of uncertainty, conservation entropy and auto-correlation of the spatial arrangements (binary representations) for every gene and genome, have been found using Shannon entropy and Hurst exponent which are described in brief in the following subsections.

#### 2.1. Shannon entropy

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- There are two kinds of Shannon entropy measures are considers in the present study as follows.
  - Binary Shannon Entropy: The Shannon entropy (SE) measures information entropy of a Bernoulli process with probability p of the two outcomes (0/1) [22, 23]. It is defined as

$$SE = -\sum_{i=1}^{2} p_i log_2(p_i)$$

where  $p_1 = \frac{k}{2^l}$  and  $p_2 = \frac{l-k}{2^l}$ ; here l is the length of the binary sequence and k is the number of 1's in the binary sequence of length l [?]. The binary Shannon entropy is a measure of the uncertainty in a binary sequence. Whenever the probability p = 0, the event is certain never to occur, and so there is no uncertainty, leading to an entropy of 0. Similarly, if the probability p = 1, the result is certain, so the entropy must be 0. When p = 0.5, the uncertainty is at a maximum and consequently the SE is 1.

Nucleotide Conservation Shannon Entropy (Con\_S): Conservation
of each of the four nucleotides has been determined using Shannon entropy
[22]. For a given nucleotide sequence, the conservation SE is calculated as
follows:

$$SE = -\sum_{i=1}^{4} p_{N_i} log_2(p_{N_i})$$

where  $p_{N_i} = \frac{k}{m}$  where 'k' represents the occurrence frequency of a nucleotide  $N_i$  in a RNA sequence of length 'm'.

# 2.2. Hurst Exponent

The Hurst Exponent (HE) is used for time series analysis to interpret the trend which could be positive or negative [24, 25]. The HE lies in between 0 to 1. The HE value 0 < HE < 0.5 and 0.5 < HE < 1 designate negative and positive auto-correlation (trend) of a time series/binary sequence respectively and HE = 0.5 denotes a absolute randomness of a time series/binary sequence.

The HE of a binary sequence  $s_n$  is defined as

$$\left(\frac{n}{2}\right)^{HE} = \frac{X(n)}{Y(n)} \tag{3}$$

where

$$Y(n) = \sqrt{\frac{1}{n} \sum_{i=1}^{n} (s_i - m)}$$

and X(n) = maxT(i, n) - minT(i, n), where

$$T(i) = \sum_{j=1}^{n} (s_i - t)$$

and

$$t = \sqrt{\frac{1}{n} \sum_{i=1}^{n} s_i}$$

The auto-correlation/trend of the binary representations as mentioned for all the ten genomes Si and their corresponding genes is obtained through the Hurst exponent.

In addition to these two spatial, length independent features, some basic derivative features such as GC content, purine-pyrimidine density etc. are obtained by using the percentage of density of each nucleotide in a given nucleotide sequence [26, 27, 28, 29, 30, 31, 32, 33].

## 95 3. Results and Illustrations

In the following subsections firstly genes of all types of CoVs are classified based on their length and accordingly based their spatial features genes are genomes are compared.

# 3.1. Length based Gene-Classification

Before proceeding further to investigate the spatial features of the genes and associated genomes, we present the list of genes with their respective length and location in the respective genome a given in Table-2. This information would classify the genes over the genomes based on their length.

Table 2: Genes across all the ten genomes with their location and respective length

Gene	Location	Length	Gene	Location	Length
G(1,11)	location: 2955829674	117	G(7,5)	location: 2652327191	669
G(2,10)	location: 2954229658	117	G(8,5)	location: 2646727135	669
G(7,10)	location: 2955829674	117	G(9,5)	location: 2646927137	669
G(8,11)	location: 2950229618	117	G(10,5)	location: 2651827186	669
G(9,11)	location: 2950429620	117	G(4,6)	location: 2763328304	672
G(10,11)	location: 2955329669	117	G(3,6)	location: 2683927513	675
G(1,8)	location: 2775627887	132	G(5,5)	location: 2495425667	714
G(8,8)	location: 2770027831	132	G(3,5)	location: 2609226832	741
G(9,8)	location: 2770227833	132	G(5,7)	location: 2591326707	795
G(10,8)	location: 2775127882	132	G(1,3)	location: 2539326220	828
G(1,6)	location: 2720227387	186	G(2,3)	location: 2537726204	828
G(2,6)	location: 2718627371	186	G(7,3)	location: 2539326220	828
G(7,6)	location: 2720227387	186	G(8,3)	location: 2533726164	828
G(8,6)	location: 2714627331	186	G(9,3)	location: 2533926166	828
G(9,6)	location: 2714827333	186	G(10,3)	location: 2538826215	828
G(10,6)	location: 2719727382	186	G(6,2)	location: 2150622342	837
G(5,3)	location: 2457624788	213	G(5,8)	location: 2672027853	1134
G(5,4)	location: 2473624957	222	G(4,2)	location: 2177322933	1161
G(1,4)	location: 2624526472	228	G(3,9)	location: 2856529800	1236
G(2,4)	location: 2622926456	228	G(1,10)	location: 2827429533	1260
G(7,4)	location: 2624526472	228	G(2,9)	location: 2825829517	1260
G(8,4)	location: 2618926416	228	G(7,9)	location: 2827429533	1260
G(9,4)	location: 2619126418	228	G(8,10)	location: 2821829477	1260
G(10,4)	location: 2624026467	228	G(9,10)	location: 2822029479	1260
$\mathbf{G}(3,7)$	location: 2758927837	249	G(10,10)	location: 2826929528	1260
G(4,5)	location: 2737327621	249	G(6,3)	location: 2235423625	1272
G(5,6)	location: 2565425902	249	G(4,7)	location: 2832029645	1326
G(5,9)	location: 2785828163	306	G(6,6)	location: 2907930425	1347
G(3,3)	location: 2553125842	312	G(2,2)	location: 2155025368	3819
G(3,4)	location: 2585126180	330	G(1,2)	location: 2156325384	3822
G(4,4)	location: 2705127380	330	G(7,2)	location: 2156325384	3822
G(6,5)	location: 2779228121	330	G(8,2)	location: 2150725328	3822
G(1,7)	location: 2739427759	366	G(9,2)	location: 2150925330	3822
G(1,9)	location: 2789428259	366	G(10,2)	location: 2155825379	3822
G(2,7)	location: 2737827743	366	$\mathbf{G}(3,2)$	location: 2145525516	4062
G(2,8)	location: 2787828243	366	G(4,3)	location: 2294227012	4071
G(7,7)	location: 2739427759	366	G(6,4)	location: 2364027716	4077
G(7,8)	location: 2789428259	366	G(5,2)	location: 2016424564	4401
G(8,7)	location: 2733827703	366	G(5,1)	location: 11420167	20054
G(8,9)	location: 2783828203	366	G(3,1)	location: 27821513	21236
G(9,7)	location: 2734027705	366	G(6,1)	location: 21021496	21287
G(9,9)	location: 2784028205	366	G(1,1)	location: 26621555	21290
G(10,7)	location: 2738927754	366	G(2,1)	location: 25321542	21290
G(10,9)	location: 2788928254	366	G(7,1)	location: 26621555	21290
G(4,8)	location: 2834228959	618	G(8,1)	location: 21021499	21290
G(5,10)	location: 2816828788	621	G(9,1)	location: 21221501	21290
G(3,8)	location: 2785228511	660	G(10,1)	location: 26121550	21290
G(1,5)	location: 2652327191	669	G(4,1)	location: 20621753	21548
G(2,5)	location: 2650727175	669	3(1,1)	2001011 2001121100	21010

The observations and immediate consequences can be drawn as follows from  $$^{105}$$  Table-2.

- The SARS-CoV2 genomes S1, S8, S9 and S10 contain eleven genes whereas the genomes S2 and S10 contain ten genes. It has been reported that the genomes S2 (from India) and S1 (from China) is similar with approximately 99.98% [?].
- The length of each of the genes G(1,11), G(2,10), G(7,10), G(8,11), G(9,11) and G(10,11) is 117. Note that the last most gene from each SARS-CoV2 genome is the smallest gene of length 117 among all the genes present

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- across the ten genomes. The loci of the genes is contained within the frame (29502..29674). It is worth noting that the genes of length 117 present in the genome S1 (from China) and S7 (from Brazil) at the fixed location: 29558..29674 though the length of the genomes (length of S1: 29903 and the length of the genome S7: 29876) are different.
- The genes G(i,6) of length 186 are present over all the SARS-CoV2 genomes Si where i=1,2,7,8,9 & 10. The locus of each genes G(i,6) presented in all the six SARS-CoV2 genomes contained in the frame 27146..27387. It is noted that the location of the genes G(1,6) and G(7,6) is at a fixed location: 27202..27387.
- The genes G(i,4) of length 228 are present over all the SARS-CoV2 genomes Si where i=1,2,7,8,9 & 10. The locus of each genes G(i,6) presented in all the six SARS-CoV2 genomes contained in the frame 26189..26472. It is noted that the location of the genes G(1,4) and G(7,4) are at a fixed location: 26245..26472.
- There is a pair of genes of length 366 present all over the six SARS-CoV2 genomes. The genes are G(1,7) [location=27394..27759], G(1,9) [location=27894..28259], G(2,7) [location=27378..27743], G(2,8) [location=27878..28243], G(7,7) [location=27394..27759], G(7,8) [location=27894..28259], G(8,7) [location=27338..27703], G(8,9) [location=27838..28203], G(9,7) [location=27340..27705], G(9,9) [location=27840..28205], G(10,7) [location=27389..27754] and G(10,9) [location=27889..28254]. Note that the pair of genes of length 366 present at a fixed gap of length 135 across all the six SARS-CoV2 genomes. As previously pointed out, the loci of the pair of genes presented over the genome S1 and S7 are exactly same. It is worth noting that the pair of genes of length 366 present consecutively over the genomes S2 and S7 (containing ten genes) whereas in others four genomes (containing 11 genes)

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- contain such pair of genes with a gap of another genes G(1,8), G(8,8), G(9,8) and G(10,8) of length 132 though surprisingly the gap of length 135 is strictly maintained across all the six SARS-CoV2 genomes.
  - The genes G(i,5) of length 669 are present over all the SARS-CoV2 genomes Si where i=1,2,7,8,9 & 10. The locus of each genes G(i,5) presented in all the six CoV genomes contained in the frame 26467..27191. It is noted that the location of the genes G(1,5) and G(7,5) is at a fixed location: 26523..27191.
  - The genes G(i,3) of length 828 are present over all the SARS-CoV2 genomes Si where i=1,2,7,8,9 & 10. The locus of each genes G(i,3) presented in all the six SARS-CoV2 genomes contained in the frame 25337..26220. It is noted that the location of the genes G(1,3) and G(7,3) is at a fixed location: 25393..26220.
  - The genes G(1,10), G(2,9), G(7,9), G(8,10), G(9,10) and G(10,10) of length 1260 are present over all the six CoV genomes. The locus of each of these genes is contained in the frame 28218..29533. It is noted that the location of the genes G(1,5) and G(7,5) is at a fixed location: 28274..29533.
  - The genes G(1,2), G(7,2), G(8,2), G(9,2) and G(10,2) of length 3822 are present over all the five SARS-CoV2 genomes. The locus of each of these genes is contained in the frame 21507..25384. It is noted that the location of the genes G(1,2) and G(7,2) is at a fixed location: 21563..25384. It is noted that there is no gene of length of length 3822 in the genome S2.
  - The largest lengthy genes G(1,1), G(2,1), G(7,1), G(8,1), G(9,1) and G(10,1) of length 21290 are present over all the six SARS-CoV2 genomes.

    The locus of each of these genes is contained in the frame 210..21555. It

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- is noted that the location of the genes G(1,1) and G(7,1) is at a fixed location: 266..21555.
  - There are three genes G(3,7), G(4,5) and G(5,6) of length 249 present among three CoV genomes S3, S4 and S5 respectively. There are other three genes G(3,4), G(4,4) and G(6,5) of length 330 present over the genomes S3, S4 and S6.

# 3.2. Compare and Contrast among Genes and Genomes of SARS-CoV2

Based on the spatial features (Table-4 and Table-5) such as SE and HE of different data type of the genes and associated genomes of six SARS-CoV2, some salient findings are adumbrated as follows:

- It is observed that the six genomes S1, S2, S7, S8, S9 and S10 do follow nearly same nucleotide densities including spatial distributions in terms of positive auto-correlation (HE) as well as the certainty of presence (SE) of the purine-pyrimidine bases. Also the spatial distributions of four nucleotide bases over the genomes S2 and S8 are exactly same. The occurrence of purine and pyrimidine bases over these six genomes are equally likely and consequently, the SE (0.98) is very close to 1 implying the uncertainty of occurrence is at maximum.
  - The minimum and maximum value attained by each parameters is given in the Table 3. From the Table 3, it is observed that the genes G(8,8), G(9,8) and G(10,8) (ORF7b) is pyrimidine-rich sequence with 63.64%. It is noted that the gene M of the genome S1 is also pyrimidine-rich with 63.64% whereas the ORF7b contains very less amount of pyrimidine bases with percentage 53.66%. The density of A, T, C and G are all same over all four aforementioned ORF7b gene including M of genome S1. Accordingly the other parameters are remained same. So the gene M of the genome

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S1 does follow the same spatial configurations as the ORF7b do in the genomes S8, S9 and S10.

- It is observed that the gene E in the genome S1 is purine-rich (53.97%) whereas other the gene E over the others five genomes S2, S7, S8, S9 and S10 are pyrimidine rich (60.09). It is noted that the spatial distribution of the gene E of S1 is identical with that of gene N of other five genomes S2, S7, S8, S9 and S10. The gene N of the five aforesaid genomes including gene E G(1,4) contain highest GC content (47.222%).
- The spatial distributions as well as nucleotide-densities over the gene ORF1ab (longest gene among all genes present in SARS-CoV2 genomes) over the six genomes do same. It is worth mentioning that the occurrence of presence of purine bases over ORF1ab is absolutely random/uncertain consequently the SE is turned out to be 1. The GC content of all these gene E in six genomes is 37.45%.
- All the spike gene S are pyrimidine-rich (above 52.1%) over the six genomes S1, S2, S7, S8, S9 and S10. The GC content of the spike gene of S1 is 35.79% whereas that in the spike gene of other five genomes is fixed at 37.3%.
  - The gene M over the five genomes S2, S7, S8, S9 and S10 do follows same spatial distribution as well as nucleotide densities. This gene M are all pyrimidine rich sequence especially the gene M over the genome S1 highly pyrimidine-rich with 63.64% which coincides with that of ORF7b of the genomes S8, S9 and S10.
  - The density of purine over the gene N across the five genomes S2, S7, S8, S9 and S10 is rich with 53.97% where as the gene N of the genome S1 is pyrimidine-rich with 54.35%. The GC content of the gene N of the five

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aforesaid genomes is centred at 47.2% whereas the GC content of gene N of the genome S1 is 39.49.

- The gene ORF3a over the six SARS-CoV2 genomes is pyrimidine-rich with 54%. The GC content of the gene in the genome S1 is 34% whereas GC content of the gene ORF3a in other five genomes is centred at 54.47%.
- The amount of purine and pyrimidine in the gene ORF6 is almost same (50%) over the five genomes except S1. The gene G(1, 6) ORF6 is pyrimidine-rich sequence. The GC content of the gene G(1,6) is 38.25% whereas that of the gene ORF6 in other five genomes is fixed at 27.956%.
- The gene G(2,7), G(7,7), G(8,7), G(9,7) and G(10,7) contains more pyrimidine bases (53.83%) than purine bases. But in the case of the gene G(1,7)-ORF7a is purine-rich with 50.54%. The GC content of the gene ORF7a over the five genomes is 38.252% but GC content of the gene G(1,7) is 27. 96%.
- The genes G(1,5)-M, G(8,8)-ORF7b, G(9,8)-ORF7b, G(10,8)-ORF7b follow exactly same density of nucleotides and pyrimidine-rich. The purinepyrimidine representations of all these four genes are positively trending with HE exactly 0.72. It is worth noting that the representations of four nucleotide bases are exactly same.

By the above observations made and corresponding numerical features as presented in the Table 4, it is evident that the density of four nucleotide bases as well as the purine-pyrimidine bases spatial distributions are significantly different from that of the genes over the five genomes of SARS-CoV2.

The feature vectors of each gene and genome are of length 19. Based on euclidean distance among the SARS-CoV2 genomes and their associated genes

are calculated and based on the distance matrix a phylogenetic tree is made which is presented in the Fig. 1.

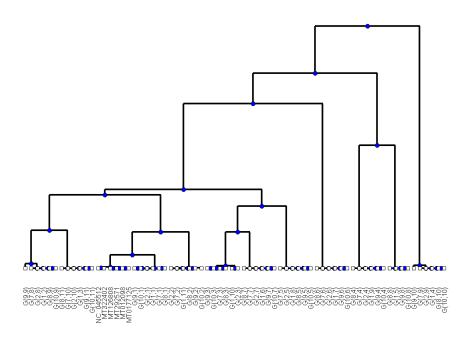


Figure 1: Phylogenetic tree of the six SARS genomes and their associated genes

The above phylogeny depicts the closeness among the six genomes and respective genes based on the 19 compound features. It is observed that the genome S1 is significantly distant from the other SARS-CoV2 genomes. It is noticed that the genes G(10,10) and g(7,10) are significantly away from each other although they both belong to the same genome S10. The pair of genes G(2,9), G(7,9) and G(8,9), G(10,9) are very close to each other but the genes G(2,9) and G(8,9) are far away from each other in the phylogenetic tree. Clearly, the above item-wise findings are reflected in the phylogenetic tree.

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3.3. Compare and Contrast among Genes and Genomes of MERS, HKU1,  $\alpha$ -CoV-1 and  $\beta$ -CoV-1

Based on the spatial features (Table-6) such as SE and HE of different data type of the genes and associated genomes of four genomes MERS, HKU1,  $\alpha$ -CoV-1 and  $\beta$ -CoV-1 some salient findings are presented:

- The pyrimidine density for gene E over the genomes S3, S4 and S5 are 55.02%, 59.84% and 53.82% respectively, i.e. the density of pyrimidine bases is significantly richer than that of purine in the gene E of the genomes S3, S4 and S5. It is noted that β-CoV-1 does not possess any E gene.
- The three genomes S3, S4 and S6 contain more pyrimidine bases than purine bases whereas the genome S5 is purine-rich sequence. The density of pyrimidine over the genomes of MERS (S3) and HKU1 (S4) is 53% whereas the density of purine and pyrimidine dominates each other with full of uncertainty of presence and absence ( $SE \simeq 1$ ). The GC content of the genomes S3, S4, S5 and S6 are 41.18%, 32.06%, 38.36% and 36.62% respectively.
- The gene HE is one of the important structural gene which is present in the β-CoV-1 such as in S4 and S6 genomes. The amount of pyrimidine is significantly higher than purine bases in these two HE genes. The GC content of the gene G(6,3) is significantly higher than that of the HE gene G(4,2).
- The purine-pyrimidine representations of the gene ORF1ab of the genomes S4(HKU1) and S6 ( $\beta$ -CoV-1) and genes NS3b, ORF7b of the genomes S3 and S5 respectively are positively trending with HE: 0.62.
- The pyrimidine density of the gene ORF1ab in the genome S3 and S4 is 52% whereas the pyrimidine density of the same gene ORF1ab of the

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genomes S5 and S6 is 50%. It is noticed that individual nucleotides density over the gene ORF1ab is different, respective to the genomes S3 and S4 but pyrimidine density are kept balanced in both S3 and S4.

- The spike gene S contains more pyrimidine bases than purine bases in the genome S3, S4 and S6 whereas the spike gene in the genome S6 contains almost equal number of purine and pyrimidine bases.
- The gene N of S6 (β-CoV-1) and ORF3b of the α-CoV-1 genome S5 contain more number of purine bases (54%) than pyrimidine bases. The GC content for the gene N of S6 is 46.4% whereas the GC content of the gene ORF3b in S5 is 31.5% which is significantly lesser that the former one.
- The gene G(3,1)-ORF1ab and G(10,2)- S are pyrimidine rich with percentage 52% and the purine-pyrimidine representation for both the genes possess HE: 0.59; that is the representation is positively trending.
- The gene G(3,6)-NS3d of the MERS genome S3 is pyrimidine rich and
  the purine-pyrimidine representations is slightly negatively trending. Note
  that the representation of the nucleotide base G is also negatively trending.
  This is an unique feature of the gene NS3d in the MERS genome over all
  the genes and genomes consider for the present study.

Distance among the other four genomes and their associated genes based on euclidean metric are calculated and based on the distance matrix a phylogenetic tree is made which is presented in the Fig. 2.

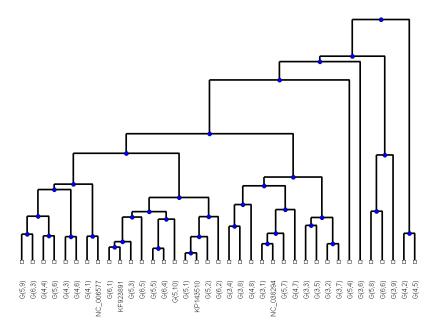


Figure 2: Phylogenetic tree of the four genomes and their associated genes

Based on the phylogenetic analysis as figured in the Fig. 2, it is observed that the genes G(4,2) and G(4,5) are very close to each other. But the gene G(4,4) is quite far away from the gene G(4,4). Also the four genomes are away from each others. The gene G(5,1) and the genome S5 are under the same leaf nodes. Similarly the genome S3 and the gene G(3,1) belong to the same leaf node implying the features vectors are close to each other. Similar observation are made for the gene G(4,1) and the genome S4. Likewise, the gene G(6,1) and the genome S6 are very close to each other.

Although the SARS-CoV2 and SARS-CoV-1, MERS are typically different, the genes and genomes share many spatial features and also differ many features among inter-intra genes and genomes. Some features are reported below based on the result tabulated in the Tables 4, 5 and 6:

- The gene N in genome S5 (α-CoV-1 and S9 (SARS-CoV2) is purine rich with 54% approximately. It is noticed that the GC content is significantly high in the gene N over the genomes S5 and S9 with respective percentage 43.39% and 47.06%.
- The densities of purine and pyrimidine bases over the gene G(10,6)- ORF6 and gene G(5,1)- ORF1a/1b are almost same. That is both the purine and pyrimidine bases are equally likely to be present over the genes and consequently the binary SE is turned out to be 0.9999.
  - The genes G(3,4)-NS3b and G(1,8)-ORF7b possess similar purine and pyrimidine density over the sequences. In both the genes, the binary representation of the purine and pyrimidine bases are positively trending. More precisely the purine-pyrimidine representation of ORF7b is much trendier than that of the gene NS3b in the genome S3.
- The presence of purine bases over the genomes S1, S10, S3 (MERS), S9,
  S7 ans S8 is almost uncertain (SE: 0.999) but the purine-pyrimidine representations are positively trending (HE: 0.65).

## 4. Conclusions and Summary

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This study reports that the genes and genomes sequences of SARS-CoV2 are very much stable (variations are less) in terms of spatial organizations as well as frequency distribution of nucleotides whereas the other genes and genomes of  $\beta$ -CoVs are typically different as mentioned in the results. It is one of the noticeable observations that the genome sequence S1 (NC\_045512) and its respective genes are significantly differently spatially organized than other CoV genomes.

Table 3: SARS Genes and their associated genomes with quantitative features

49.95         1.00         37.450         1.0000           54.10         0.85         35.790         0.0951           53.85         0.86         34.190         0.9957           64.03         1.17         31.000         0.9957           65.64         0.57         31.000         0.9957           53.83         0.86         38.250         0.9958           60.09         0.86         38.260         0.9968           60.09         0.86         38.160         0.9945           50.17         0.82         37.31         0.9945           50.15         0.86         37.44         0.9945           50.15         0.87         37.44         0.9945           50.15         0.87         37.44         0.9945           50.15         0.86         37.44         0.9945           50.16         0.87         37.31         0.9945           50.16         0.86         38.18         0.9945           50.10         0.86         38.18         0.9945           50.10         0.86         38.18         0.9945           50.10         0.86         38.18         0.9945           50.10	Sed	% (A)	(L) %	% (C)	% (G)	(%) Pu	(%) Py	Pu/Py	% (GC)	B_S	Con_S	S_A	S_C	S_G	S_T	В-Н	H_A	H_C	H_G	H_T
2.9.2         3.6.1         17.4         18.31         45.90         54.10         0.85         35.70         0.965         0.95         0.65         0.67         0.69         0.95	G(1,1)	30.18	32.37	17.59	19.87	50.05	49.95	1.00	37.450	1.0000	0.9763	0.88	0.67	0.72	0.91	0.64	0.62	0.57	0.59	0.67
3.9.7         3.5.9.0         17.95         16.24         46.15         5.3.85         0.86         34.190         0.9967         0.9910         0.88         0.68         0.64         0.54         0.55           2.3.4         45.46         18.18         12.28         56.36         0.57         0.9967         0.9904         0.99         0.9904         0.99         0.9904         0.990         0.9904         0.990         0.9904         0.9904         0.990         0.9904	G(1,2)	27.60	36.61	17.49	18.31	45.90	54.10	0.85	35.790	0.9951	0.9658	0.85	0.67	69.0	0.95	0.59	0.57	0.59	0.59	0.63
3.175         2.103         5.500         2.22         5.397         4.60.3         1.17         4.72.20         6.9955         6.9965         0.9964         0.09         0.81         0.75         0.75         0.75           2.5.5         5.2.4         1.1.5         4.6.3         1.1.7         31.00         0.9955         0.9964         0.09         0.75 <td< td=""><td>G(1,3)</td><td>29.92</td><td>35.90</td><td>17.95</td><td>16.24</td><td>46.15</td><td>53.85</td><td>98.0</td><td>34.190</td><td>0.9957</td><td>0.9610</td><td>0.88</td><td>0.68</td><td>0.64</td><td>0.94</td><td>0.65</td><td>0.67</td><td>0.53</td><td>0.52</td><td>0.62</td></td<>	G(1,3)	29.92	35.90	17.95	16.24	46.15	53.85	98.0	34.190	0.9957	0.9610	0.88	0.68	0.64	0.94	0.65	0.67	0.53	0.52	0.62
29.3.49         45.46         18.18         12.88         36.36         6.57         31.000         0.9457         0.9180         0.75         0.05 <td>G(1,4)</td> <td>31.75</td> <td>21.03</td> <td>25.00</td> <td>22.22</td> <td>53.97</td> <td>46.03</td> <td>1.17</td> <td>47.220</td> <td>0.9955</td> <td>0.9904</td> <td>06.0</td> <td>0.81</td> <td>0.76</td> <td>0.74</td> <td>0.57</td> <td>0.62</td> <td>0.51</td> <td>0.56</td> <td>0.53</td>	G(1,4)	31.75	21.03	25.00	22.22	53.97	46.03	1.17	47.220	0.9955	0.9904	06.0	0.81	0.76	0.74	0.57	0.62	0.51	0.56	0.53
25.54         32.24         11.59         16.67         46.18         53.83         0.86         32.20         0.9958         0.9772         0.88         0.75         0.65         0.91         0.65         0.91         0.65         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.75         0.75         0.95         0.95         0.95         0.75         0.75         0.95         0.95         0.95         0.75         0.75         0.95         0.95         0.95         0.75         0.75         0.75         0.95	G(1,5)	23.49	45.46	18.18	12.88	36.36	63.64	0.57	31.060	0.9457	0.9180	0.79	89.0	0.55	0.99	0.72	0.71	0.54	0.53	0.72
25.56         31.84         13.98         13.98         13.98         13.98         13.98         13.98         13.98         13.98         13.98         13.98         13.98         13.98         13.98         13.98         13.98         13.98         13.84         13.84         13.84         13.84         13.84         13.84         13.84         13.84         13.84         13.84         13.84         13.84         13.84         14.55         10.94         0.04945         0.958         0.75         0.75         0.74         0.99         0.975         0.75         0.74         0.99         0.975         0.75         0.74         0.99         0.975         0.75         0.74         0.99         0.97         0.75         0.75         0.75         0.75         0.75         0.99         0.975         0.75         0.75         0.99         0.97         0.75         0.75         0.99         0.97         0.77         0.75         0.69         0.86         38.109         0.97         0.77         0.75         0.74         0.99         0.92         0.77         0.99         0.77         0.75         0.74         0.99         0.92         0.77         0.77         0.72         0.99         0.99	G(1,6)	29.51	32.24	21.59	16.67	46.18	53.83	98.0	38.250	0.9958	0.9772	88.0	0.75	0.65	0.91	09.0	0.59	0.58	0.52	0.57
2.5.56         31.84         21.82         20.78         46.34         5.36         0.86         42.600         0.9904         0.9883         0.75         0.74         0.90         0.65           27.17         33.33         21.01         18.43         46.34         6.049         0.84         39.490         0.9904         0.9883         0.75         0.77         0.69         0.97         0.9904         0.9785         0.74         0.69         0.97         0.98         0.99         0.97         0.74         0.69         0.97         0.65         0.99         0.99         0.9785         0.74         0.69         0.97         0.66         0.99         0.99         0.9785         0.88         0.69         0.71         0.99         0.99         0.9785         0.88         0.69         0.71         0.99         0.60         0.99         0.99         0.975         0.88         0.69         0.71         0.99         0.99         0.99         0.975         0.88         0.69         0.71         0.99         0.66         38.41         0.09         0.98         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99	G(1,7)	36.56	35.48	13.98	13.98	50.54	49.46	1.02	27.960	0.9999	0.9274	0.95	0.58	0.58	0.94	09.0	0.64	0.51	0.65	0.62
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	G(1,8)	25.56	31.84	21.82	20.78	46.34	53.66	98.0	42.600	0.9961	0.9895	0.82	92.0	0.74	06.0	0.63	0.64	0.62	0.57	99.0
27.17         33.33         21.01         18.48         45.65         54.35         0.84         39.490         0.9365         0.9756         0.92         0.66         0.92         0.65           29.44         32.38         18.31         18.34         45.65         56.45         0.98         37.31         0.9986         0.9756         0.88         0.67         0.72         0.91         0.52           29.44         32.08         18.37         19.61         49.55         50.45         0.98         0.9756         0.88         0.67         0.72         0.91         0.65           29.44         32.08         18.33         18.38         47.81         52.14         0.9986         0.9757         0.88         0.67         0.72         0.91         0.65           29.43         18.48         45.66         0.84         39.49         0.9986         0.75         0.75         0.72         0.91         0.65           29.41         18.48         45.46         0.98         35.75         0.9583         0.975         0.74         0.89         0.92         0.66           29.41         18.41         18.41         18.42         1.0099         0.975         0.75	G(1,9)	21.49	40.35	19.74	18.42	39.91	60.09	99.0	38.160	0.9704	0.9583	0.75	0.72	69.0	0.97	0.62	0.64	0.55	0.57	0.56
2944         33.26         18.92         18.93         47.83         52.17         0.92         37.31         0.9996         0.9785         0.87         0.70         0.69         0.92         0.9785         0.89         0.69         0.9785         0.89         0.69         0.9785         0.89         0.69         0.98         0.69         0.98         0.69         0.98         0.69         0.92         0.58         0.69         0.92         0.58         0.69         0.92         0.58         0.69         0.71         0.91         0.65         0.89         0.99         0.99         0.98         0.69         0.74         0.69         0.72         0.63         0.62         0.93         0.93         0.92         0.58         0.69         0.74         0.93         0.92         0.58         0.69         0.74         0.93         0.92         0.58         0.92         0.74         0.93         0.92         0.74         0.93         0.94<	G(1,10)	27.17	33.33	21.01	18.48	45.65	54.35	0.84	39.490	0.9945	0.9811	0.84	0.74	0.69	0.92	99.0	99.0	09.0	0.54	0.64
29.94         32.08         18.37         19.61         49.55         50.44         10.0009         0.9762         0.88         0.69         0.77         0.91         0.65           29.43         32.08         18.37         19.61         49.55         10.00         37.34         10.009         0.9762         0.88         0.67         0.71         0.91         0.64           29.43         32.26         18.93         47.81         52.10         0.92         0.744         0.986         0.9757         0.72         0.92         0.54           27.17         33.32         19.74         18.42         45.61         6.21         0.92         0.75         0.72         0.99         0.97         0.74         0.99         0.97         0.74         0.99         0.95         0.97         0.74         0.99         0.97         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.95         0.99         0.95         0.95         0.99         0.97         0.99         0.99         0.99         0.97         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99	G(1,11)	29.44	33.26	18.92	18.39	47.83	52.17	0.92	37.310	0.9986	0.9756	0.87	0.70	0.69	0.92	0.58	09.0	0.59	0.55	0.62
30.18         32.38         17.58         18.97         50.05         49.95         10.0         37.444         1.000         0.9754         0.986         0.877         0.78         0.67         0.91         0.54           27.17         33.33         21.01         18.48         45.65         54.35         0.92         37.34         0.9986         0.877         0.77         0.69         0.92         0.65           27.17         33.33         21.01         18.48         45.65         54.35         0.84         39.492         0.9945         0.9810         0.67         0.69         0.92         0.66           27.17         33.33         19.74         18.48         45.65         54.36         0.86         38.25         0.79         0.79         0.69         0.92         0.66           21.49         10.30         0.86         38.25         0.9969         0.9958         0.75         0.76         0.74         0.90         0.66           21.40         3.66         38.41         0.9969         0.9959         0.9977         0.86         0.91         0.60         0.90         0.90         0.90         0.90         0.90         0.90         0.90         0.90         0	NC_045512	29.94	32.08	18.37	19.61	49.55	50.45	86.0	37.97	0.9999	0.9785	88.0	69.0	0.71	0.91	0.65	0.61	0.65	0.61	89.0
29.43         33.26         18.93         18.38         47.81         52.19         0.945         0.945         0.947         0.84         0.77         0.89         0.977         0.84         0.77         0.89         0.95         0.94         0.94         0.94         0.94         0.94         0.94         0.74         0.69         0.92         0.58           21.49         40.35         19.74         18.42         39.91         60.09         0.66         38.158         0.974         0.758         0.75         0.74         0.69         0.97         0.66         0.97         0.84         0.84         0.87         0.89         0.97         0.75         0.74         0.69         0.97         0.85         0.87         0.89         0.97         0.89         0.97         0.89         0.97         0.89         0.97         0.89         0.97         0.89         0.99         0.97         0.89         0.97         0.89         0.99         0.97         0.89         0.99         0.97         0.89         0.99         0.99         0.97         0.89         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99	G(2,1)	30.18	32.38	17.58	19.87	50.05	49.95	1.00	37.444	1.0000	0.9762	88.0	0.67	0.72	0.91	0.64	0.62	0.57	0.59	0.67
7.17 $33.33$ $21.01$ $18.48$ $45.65$ $54.35$ $0.84$ $39.492$ $0.99045$ $0.84$ $0.74$ $0.69$ $0.99045$ $0.9804$ $0.74$ $0.69$ $0.92$ $0.66$ $0.92$ $0.92$ $0.66$ $0.92$ $0.92$ $0.92$ $0.66$ $0.92$ $0.92$ $0.92$ $0.92$ $0.92$ $0.92$ $0.92$ $0.92$ $0.92$	G(2,2)	29.43	33.26	18.93	18.38	47.81	52.19	0.92	37.314	0.9986	0.9757	0.87	0.70	0.69	0.92	0.58	09.0	0.59	0.55	0.62
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	G(2,3)	27.17	33.33	21.01	18.48	45.65	54.35	0.84	39.492	0.9945	0.9811	0.84	0.74	69.0	0.92	99.0	99.0	09.0	0.54	0.64
2.556 $31.84$ $21.82$ $20.78$ $46.34$ $53.66$ $0.86$ $42.601$ $0.9991$ $0.9895$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.772$ $0.9992$ $0.7774$ $0.95$ $0.772$ $0.9992$ $0.9772$ $0.9992$ $0.9772$ $0.9992$ $0.9772$ $0.9992$ $0.9772$ $0.9992$ $0.9772$ $0.9992$ $0.9772$ $0.9992$ $0.9772$ $0.9992$ $0.9772$ $0.9992$ $0.9772$ $0.9992$ $0.9992$ $0.9772$ $0.9992$ $0.9992$ $0.9772$ $0.9992$ $0.9992$ $0.9772$ $0.9992$ $0.9992$ $0.9772$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$ $0.9992$	G(2,4)	21.49	40.35	19.74	18.42	39.91	60.09	99.0	38.158	0.9704	0.9583	0.75	0.72	69.0	0.97	0.62	0.64	0.55	0.57	0.56
36.56         35.48         13.98         15.54         49.46         10.2         27.956         0.9958         0.9772         0.58         0.58         0.59         0.94         0.05         0.97         0.05         0.95         0.05         0.05         0.94         0.06         0.05	G(2,5)	25.56	31.84	21.82	20.78	46.34	53.66	98.0	42.601	0.9961	0.9895	0.82	92.0	0.74	06.0	0.63	0.64	0.62	0.57	99.0
29.51 $32.24$ $21.59$ $16.67$ $46.18$ $5.3.3$ $0.86$ $38.25$ $0.9658$ $0.772$ $0.88$ $0.772$ $0.9658$ $0.772$ $0.88$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.772$ $0.9668$ $0.776$ $0.964$ $0.776$ $0.969$ $0.776$ $0.969$ $0.776$ $0.969$ $0.776$ $0.776$ $0.969$ $0.776$ $0.969$ $0.776$ $0.776$ $0.969$ $0.776$ $0.969$ $0.776$ $0.776$ $0.969$ $0.776$ $0.776$ $0.969$ $0.776$ $0.776$ $0.969$ $0.776$ $0.776$ $0.969$ $0.776$ $0.969$ $0.776$ $0.969$	G(2,6)	36.56	35.48	13.98	13.98	50.54	49.46	1.02	27.956	0.9999	0.9274	0.95	0.58	0.58	0.94	09.0	0.64	0.51	0.65	0.62
27.60 $36.61$ $17.49$ $18.31$ $45.90$ $54.10$ $0.85$ $35.792$ $0.9958$ $0.9968$ $0.85$ $0.67$ $0.995$ $0.95$ $0.96$ $0.85$ $0.95$ $0.95$ $0.95$ $0.96$	G(2,7)	29.51	32.24	21.59	16.67	46.18	53.83	98.0	38.252	0.9958	0.9772	0.88	0.75	0.65	0.91	09.0	0.59	0.58	0.52	0.57
31.75         21.03         25.00         22.22         53.97         46.03         1.17         47.22         0.9955         0.9910         0.81         0.81         0.74         0.75           29.86         22.12         18.39         19.63         49.49         50.51         0.98         34.188         0.9957         0.9910         0.88         0.68         0.64         0.94         0.65           29.86         22.12         18.39         19.63         49.49         50.51         0.98         38.018         0.9959         0.9786         0.88         0.67         0.71         0.69           29.86         22.12         18.39         49.49         50.51         0.98         38.018         0.9966         0.87         0.75         0.72         0.91         0.64           29.18         23.40         1.00         37.31         0.9986         0.87         0.75         0.72         0.92         0.56           27.17         33.45         1.00         37.31         0.9986         0.87         0.75         0.72         0.92         0.56           27.17         4.18         2.10         1.8.31         6.34         4.54         0.86         38.15         0.	G(2,8)	27.60	36.61	17.49	18.31	45.90	54.10	0.85	35.792	0.9951	0.9658	0.85	0.67	69.0	0.95	0.59	0.57	0.59	0.59	0.63
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	G(2,9)	31.75	21.03	25.00	22.22	53.97	46.03	1.17	47.222	0.9955	0.9904	0.90	0.81	0.76	0.74	0.57	0.62	0.51	0.56	0.53
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	G(2,10)	29.92	35.90	17.95	16.24	46.15	53.85	98.0	34.188	0.9957	0.9610	0.88	89.0	0.64	0.94	0.65	0.67	0.53	0.52	0.62
30.18         32.37         17.59         18.96         50.04         49.96         1.00         37.45         1.00         0.9763         0.88         0.67         0.72         0.91         0.64           29.44         33.26         18.39         47.83         52.17         0.92         37.31         0.9966         0.9766         0.84         0.77         0.69         0.92         0.58           21.47         33.26         1.01         18.36         45.33         54.47         0.84         39.371         0.9996         0.9766         0.84         0.77         0.69         0.92         0.58           21.49         40.35         19.74         18.42         39.91         60.09         0.66         38.158         0.9764         0.98         0.77         0.75         0.77         0.69         0.97         0.62           25.56         31.84         13.98         50.54         49.46         1.02         27.966         0.9999         0.977         0.95         0.99         0.97         0.65         0.60         0.97         0.60         0.91         0.60         0.91         0.60         0.91         0.60         0.91         0.60         0.92         0.65         0.92<	MT012098	29.86	32.12	18.39	19.63	49.49	50.51	96.0	38.018	0.9999	0.9786	0.88	0.69	0.71	0.91	0.64	0.61	99.0	0.62	89.0
29.44         33.26         18.92         47.83         52.17         0.92         37.31         0.9366         0.947         0.70         0.69         0.92         0.58           27.17         33.45         21.01         18.89         47.83         52.17         0.84         33.31         0.9466         0.9476         0.87         0.74         0.69         0.92         0.58           21.49         40.35         19.74         18.42         39.91         60.09         0.66         38.18         0.9704         0.9806         0.84         0.74         0.69         0.92         0.58           25.56         31.84         21.82         20.78         46.34         1.02         27.966         0.9999         0.9774         0.69         0.97         0.63           29.51         32.24         21.59         16.67         46.18         53.83         0.86         38.252         0.9958         0.9772         0.89         0.97         0.60           27.50         36.61         17.49         18.31         45.90         54.10         0.85         38.252         0.9958         0.977         0.88         0.95         0.91         0.60           27.50         36.61	G(7,1)	30.18	32.37	17.59	19.86	50.04	49.96	1.00	37.45	1.0000	0.9763	0.88	0.67	0.72	0.91	0.64	0.62	0.57	0.59	0.67
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	G(7,2)	29.44	33.26	18.92	18.39	47.83	52.17	0.92	37.311	0.9986	0.9756	0.87	0.70	0.69	0.92	0.58	09.0	0.59	0.55	0.62
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	G(7,3)	27.17	33.45	21.01	18.36	45.53	54.47	0.84	39.371	0.9942	9086.0	0.84	0.74	0.69	0.92	0.65	99.0	09.0	0.54	0.64
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	G(7,4)	21.49	40.35	19.74	18.42	39.91	60.09	99.0	38.158	0.9704	0.9583	0.75	0.72	0.69	0.97	0.62	0.64	0.55	0.57	0.56
36.56         35.48         13.98         50.54         49.46         1.02         27.956         0.9999         0.9274         0.55         0.58         0.58         0.59         0.60           29.51         32.24         21.59         16.67         46.18         53.83         0.68         38.572         0.9958         0.975         0.65         0.51         0.60           27.50         36.1         7.49         18.31         45.90         54.10         0.85         35.79         0.9958         0.85         0.67         0.69         0.51         0.60           31.75         21.03         25.00         22.22         53.97         46.03         1.17         47.22         0.9956         0.9904         0.90         0.81         0.76         0.74         0.57           29.92         35.90         16.24         46.15         53.85         0.86         34.188         0.9977         0.9610         0.88         0.64         0.65           9.92         35.90         4.61.5         53.85         0.86         34.188         0.9977         0.9610         0.88         0.64         0.97         0.65	G(7,5)	25.56	31.84	21.82	20.78	46.34	53.66	98.0	42.601	0.9961	0.9895	0.82	0.76	0.74	06.0	0.63	0.64	0.62	0.57	99.0
29.51         32.24         21.59         16.67         46.18         53.83         0.86         38.252         0.9958         0.975         0.85         0.75         0.65         0.91         0.60           27.60         36.61         17.49         18.31         45.90         54.10         0.85         31.75         0.9958         0.975         0.85         0.67         0.69         0.99         0.85         0.87         0.69         0.99         0.87         0.69         0.87         0.69         0.99         0.87         0.69         0.87         0.69         0.74         0.57         0.59         0.8	G(7,6)	36.56	35.48	13.98	13.98	50.54	49.46	1.02	27.956	0.9999	0.9274	0.95	0.58	0.58	0.94	09.0	0.64	0.51	0.65	0.62
$ 27.60  36.61  17.49  18.31  45.90  54.10  0.85  35.792  0.9951  0.9658  0.85  0.67  0.69  0.95  0.59 \\ 31.75  21.03  25.00  22.22  53.97  46.03  1.17  47.222  0.9957  0.9914  0.90  0.81  0.76  0.74  0.57 \\ 29.92  25.90  17.95  16.24  46.15  53.85  0.68  34.188  0.9957  0.9910  0.88  0.68  0.64  0.94  0.65 \\ 29.88  29.19  18.38  19.67  40.51  50.50  0.08  38.01  0.0000  0.726  0.88  0.67  0.91  0.65 \\ 29.89  29.99  $	G(7,7)	29.51	32.24	21.59	16.67	46.18	53.83	98.0	38.252	0.9958	0.9772	0.88	0.75	0.65	0.91	09.0	0.59	0.58	0.52	0.57
31.75 21.03 25.00 22.22 53.97 46.03 1.17 47.222 0.9955 0.9904 0.90 0.81 0.76 0.74 0.57 29.92 35.90 17.95 16.24 46.15 53.85 0.86 34.188 0.957 0.9510 0.88 0.68 0.64 0.65 29.88 3.19 18.38 19.65 0.65 0.786 0.786 0.786 0.786 0.786 0.787 0.	G(7,8)	27.60	36.61	17.49	18.31	45.90	54.10	0.85	35.792	0.9951	0.9658	0.85	0.67	0.69	0.95	0.59	0.57	0.59	0.59	0.63
29.92 35.90 17.95 16.24 46.15 53.85 0.86 34.188 0.967 0.9610 0.88 0.64 0.65 79.4 0.65 79.88 79.17 18.8 19.67 46.15 75.60 10.88 78.01 10.0000 10.786 10.88 0.60 17.11 10.1 10.10 16.5	G(7,9)	31.75	21.03	25.00	22.22	53.97	46.03	1.17	47.222	0.9955	0.9904	0.90	0.81	92.0	0.74	0.57	0.62	0.51	0.56	0.53
29.88 32.12 18.38 19.62 49.50 50.50 0.98 38.001 0.9999 0.9786 0.88 0.69 0.71 0.91 0.65	G(7,10)	29.92	35.90	17.95	16.24	46.15	53.85	98.0	34.188	0.9957	0.9610	0.88	0.68	0.64	0.94	0.65	0.67	0.53	0.52	0.62
20:00 10:00 10:00 0:00 0:00 0:00 0:00 0:	MT126808	29.88	32.12	18.38	19.62	49.50	50.50	96.0	38.001	0.9999	0.9786	0.88	0.69	0.71	0.91	0.65	0.61	99.0	0.62	89.0

Table 4: SARS Genes and their associated genomes with quantitative features

	0.9763 0.9756 0.9806 0.9583 0.9895 0.9274	1,0000 0.9756 0.9942 0.9966 0.9756 0.9942 0.9886 0.9983 0.9961 0.9885 0.9961 0.9895 0.9965 0.9965 0.9965 0.9965 0.9965 0.9965 0.9965 0.9965 0.9965 0.9966 0.	37.45 1.0000 0.9753 37.31 0.9986 0.9756 38.371 0.9986 0.9756 38.158 0.8704 0.9885 42.601 0.9991 0.9895 31.061 0.9955 0.9991 0.9772 31.061 0.9955 0.9991 0.9786 37.444 1.0000 0.9776 38.158 0.9999 0.9786 38.158 0.9999 0.9786 38.158 0.9999 0.9786 38.158 0.9999 0.9786 38.158 0.9999 0.9786 38.158 0.9999 0.9786 38.158 0.9704 0.9895 38.158 0.9704 0.9895 38.252 0.9999 0.9274 38.252 0.9999 0.9274 38.252 0.9999 0.9274 38.252 0.9999	1.00 37.45 1.0000 0.9753 1.0000 0.9756 0.84 39.371 0.9986 0.9756 0.84 39.371 0.9986 0.9756 0.86 38.158 0.9996 0.9583 0.86 38.158 0.9995 0.9274 0.986 38.252 0.9958 0.9774 0.986 38.252 0.9958 0.9772 0.985 0.9957 0.985 0.985 0.9957 0.985 0.9957 0.985 0.995 0.9957 0.985 0.9957 0.985 0.9957 0.	49.96         1.00         37.45         1.00         0.94         37.45         1.00         0.9756           52.17         0.94         37.31         0.9986         0.9756         0.9756           60         0.86         38.158         0.9961         0.9866         0.9766           53.83         0.86         42.601         0.9961         0.9824         0.9583           54.10         0.87         38.222         0.9968         0.9772         0.9774           54.10         0.87         38.222         0.9968         0.9772         0.9180           54.10         0.85         38.792         0.9951         0.9964         0.9964           50.51         0.86         38.4188         0.9951         0.9964         0.9964           50.51         0.86         38.4188         0.9965         0.9964         0.9964           50.51         0.98         37.444         0.9999         0.9776         0.9766           52.17         0.99         37.441         0.9966         0.9776         0.9568           60.40         0.66         38.148         0.9661         0.9866         0.9776           52.16         0.99         0.9774	49.96         1.00         37.45         1.00         0.9756           49.96         1.00         37.41         1.000         0.9756           54.47         0.84         39.371         0.9986         0.9756           50.09         0.66         38.158         0.9942         0.9866           53.66         0.86         42.601         0.9961         0.9885           44.66         1.02         27.960         0.9969         0.9774           53.83         0.86         38.252         0.9958         0.9772           54.10         0.85         38.1061         0.9951         0.9974           50.51         0.86         38.1061         0.9951         0.9964           50.51         0.86         34.188         0.9957         0.9961           50.51         0.88         38.118         0.9999         0.9778           50.51         0.98         38.118         0.9999         0.9776           51.77         0.82         37.444         1.000         0.9762           51.77         0.82         38.118         0.9942         0.9866           52.66         0.86         32.56         0.9996         0.9786	50.04         49.96         1.00         37.45         1.00         0.976           45.53         52.17         0.92         37.41         0.9986         0.9756           39.31         0.0986         0.9756         0.9756         0.9756           46.34         53.47         0.84         39.31         0.9986         0.9756           46.34         53.66         0.86         42.61         0.9961         0.3865           46.34         53.66         0.86         42.61         0.9961         0.3874           46.35         63.64         0.57         31.061         0.9958         0.9772           45.90         54.10         0.85         35.792         0.9951         0.9688           45.90         54.10         0.85         35.792         0.9951         0.9678           45.50         54.10         0.86         34.18         0.9957         0.9108           40.50         50.51         0.98         38.016         0.9766           47.53         52.17         0.98         37.44         1.000         0.9766           47.53         52.17         0.98         38.016         0.9766         0.9766           45.53	19.86         50.04         49.96         1.00         37.45         1.000         0.9763           18.36         47.83         52.17         0.92         37.31         0.9986         0.9756           18.36         47.83         52.17         0.94         37.31         0.9986         0.9756           18.42         39.91         60.09         0.66         38.158         0.9986         0.9756           20.78         46.34         53.60         0.86         38.152         0.9967         0.9867           16.67         46.13         53.83         0.86         38.252         0.9968         0.9774           16.67         46.13         6.0         0.86         38.152         0.9968         0.9774           18.31         45.90         54.10         0.85         38.202         0.9968         0.9774           18.31         45.90         54.10         0.85         34.128         0.9967         0.9610           19.63         49.50         54.10         0.98         34.16         0.9999         0.9776           19.87         50.05         49.95         1.00         37.44         1.000         0.9776           18.39         47.83 </th
.82	0.9895 0.9895 0.9895 0.9274	0.9942 0.9806 0.9744 0.9883 0.9674 0.9895 0.9958 0.9772 0.9957 0.9180 0.9957 0.9180 0.9957 0.9180 0.9957 0.9180 0.9957 0.9186 0.9957 0.9186 0.9958 0.9756 0.9942 0.9806 0.9756 0.9942 0.9806 0.9756 0.9942 0.9806	39.371 0.9942 0.9806 39.371 0.9942 0.9806 42.601 0.9961 0.9895 42.601 0.9969 0.9274 38.252 0.9959 0.9274 47.222 0.9955 0.9904 47.222 0.9955 0.9904 38.018 0.9957 0.9786 37.444 1.0000 0.9762 37.311 0.9842 0.9786 38.158 0.9974 0.9806 38.158 0.9974 0.9806 38.158 0.9774 0.9981 42.601 0.9942 0.9806 27.966 0.9999 0.9274 38.252 0.9953 0.9274	0.84 39.371 0.9942 0.9806 0.66 38.158 0.9704 0.9883 0.66 42.601 0.9961 0.9883 0.66 42.601 0.9961 0.9982 0.9806 0.68 42.601 0.9965 0.9974 0.9883 0.6774 0.9985 0.9974 0.9883 0.6774 0.9985 0.9974 0.9883 0.68 38.108 0.9955 0.9961 0.9986 0.9786 0.999 0.9786 0.9999 0.9786 0.9999 0.9786 0.9999 0.9978 0.9999 0.9786 0.9999 0.9786 0.9999 0.9978 0.88 38.108 0.9994 0.9889 0.9774 0.9889 0.9774 0.9889 0.9774 0.9889 0.9974 0.9889 0.9774 0.9889 0.9977 0.9889 0.9774 0.9889 0.9977 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9889 0.9777 0.9989 0.9777 0.9889 0.9777 0.9889 0.9777 0.9989 0.9777 0.9889 0.9777 0.9989 0.9777 0.9889 0.9	54.47         0.84         39.371         0.945         0.9806           0.00         0.66         38.188         0.9704         0.9806           53.66         0.86         42.601         0.9961         0.9895           53.83         0.86         38.188         0.9961         0.9895           53.84         0.86         38.252         0.9969         0.9772           54.10         0.57         31.061         0.9457         0.9172           54.10         0.85         38.252         0.9951         0.9172           54.10         0.87         34.188         0.9957         0.9064           50.38         0.86         34.188         0.9957         0.901           50.11         47.222         0.9959         0.7766         0.901           50.21         0.88         38.016         0.9999         0.7766           52.17         0.92         37.441         0.906         0.7766           52.17         0.68         38.158         0.9966         0.7766           50.66         0.86         42.601         0.9961         0.9856           60.40         0.86         38.22         0.9968         0.9772	45.53         54.47         0.84         39.371         0.9942         0.9806           39.91         60.09         0.66         38.188         0.9704         0.9808           46.34         53.66         0.86         38.188         0.9704         0.9805           46.14         0.66         38.188         0.9904         0.9805         0.9774           46.18         53.83         0.86         38.222         0.9961         0.9805           46.18         53.84         0.57         31.061         0.9457         0.9180           53.67         46.03         1.17         47.222         0.9955         0.9014           46.15         53.85         0.86         34.188         0.9957         0.9014           46.15         50.51         0.98         34.188         0.9957         0.9014           46.15         50.51         0.98         37.444         1.0000         0.9765           45.30         40.95         1.00         37.444         0.9942         0.9806           45.33         54.47         0.86         37.311         0.9942         0.9806           45.48         5.17         0.86         37.311         0.9942 <td< td=""><td>18.36         45.53         54.47         0.84         39.371         0.9942         0.9806           18.42         39.91         60.09         0.66         38.158         0.9704         0.9806           18.42         39.91         60.09         0.66         42.601         0.9961         0.9806           18.98         50.54         46.16         1.02         27.956         0.9996         0.9274           16.67         46.18         53.83         0.86         38.252         0.9956         0.9274           12.88         36.36         63.64         0.57         31.061         0.9957         0.9180           22.22         53.87         46.03         1.17         47.222         0.9955         0.9967           16.24         46.15         53.85         0.86         34.188         0.967         0.9610           16.24         46.15         53.85         0.86         34.188         0.967         0.9610           19.43         49.50         50.51         0.98         38.016         0.9957         0.9610           19.83         45.50         52.17         0.92         37.344         1.0000         0.9762           18.36</td><td>21.01         18.36         45.53         54.47         0.84         39.371         0.9942         0.9806           21.01         18.36         45.53         54.47         0.84         39.371         0.9942         0.9806           21.82         20.78         46.34         53.66         0.86         42.61         0.9941         0.9806           21.82         20.78         46.34         49.46         1.02         27.956         0.9991         0.9274           18.38         16.67         46.18         53.83         0.86         38.252         0.9957         0.9274           18.18         18.31         46.59         63.44         0.57         31.061         0.9957         0.9180           25.00         22.22         53.97         46.03         1.17         47.28         0.9957         0.9180           17.95         16.24         46.15         53.85         0.86         34.188         0.9957         0.9180           17.54         18.39         47.83         50.51         0.98         34.188         0.9957         0.9180           17.55         19.63         49.50         1.00         37.444         1.0000         0.9762           <t< td=""></t<></td></td<>	18.36         45.53         54.47         0.84         39.371         0.9942         0.9806           18.42         39.91         60.09         0.66         38.158         0.9704         0.9806           18.42         39.91         60.09         0.66         42.601         0.9961         0.9806           18.98         50.54         46.16         1.02         27.956         0.9996         0.9274           16.67         46.18         53.83         0.86         38.252         0.9956         0.9274           12.88         36.36         63.64         0.57         31.061         0.9957         0.9180           22.22         53.87         46.03         1.17         47.222         0.9955         0.9967           16.24         46.15         53.85         0.86         34.188         0.967         0.9610           16.24         46.15         53.85         0.86         34.188         0.967         0.9610           19.43         49.50         50.51         0.98         38.016         0.9957         0.9610           19.83         45.50         52.17         0.92         37.344         1.0000         0.9762           18.36	21.01         18.36         45.53         54.47         0.84         39.371         0.9942         0.9806           21.01         18.36         45.53         54.47         0.84         39.371         0.9942         0.9806           21.82         20.78         46.34         53.66         0.86         42.61         0.9941         0.9806           21.82         20.78         46.34         49.46         1.02         27.956         0.9991         0.9274           18.38         16.67         46.18         53.83         0.86         38.252         0.9957         0.9274           18.18         18.31         46.59         63.44         0.57         31.061         0.9957         0.9180           25.00         22.22         53.97         46.03         1.17         47.28         0.9957         0.9180           17.95         16.24         46.15         53.85         0.86         34.188         0.9957         0.9180           17.54         18.39         47.83         50.51         0.98         34.188         0.9957         0.9180           17.55         19.63         49.50         1.00         37.444         1.0000         0.9762 <t< td=""></t<>
0.75		0.9704 0.9961 0.9963 0.9958 0.9957 0.9957 0.9957 0.9999 1.0000 0.9942 0.9942	38.158 0.9704 42.601 0.9904 27.956 0.9990 38.252 0.9958 31.061 0.9457 34.188 0.9955 37.341 0.9965 37.311 0.9942 38.158 0.9704 42.601 0.9961 27.966 0.9999 37.440 0.9961	0.66 38.158 0.9704 0.86 42.601 0.9961 0.86 38.252 0.9958 0.57 31.061 0.9957 0.85 31.78 0.9957	60.09 0.66 38.158 0.9704 49.46 1.02 27.956 0.9961 49.46 1.02 27.956 0.9961 63.64 0.57 31.061 0.9457 64.03 1.17 47.22 0.9955 63.85 0.86 34.188 0.9957 65.18 0.98 34.11 0.9965 65.17 0.92 37.311 0.9966 65.17 0.92 37.311 0.9966 65.17 0.86 38.188 0.9967 60.09 0.66 38.188 0.9961 65.18 0.86 42.601 0.9961 65.88 0.86 42.601 0.9969 63.83 0.86 38.252 0.9958	39.91         60.09         0.66         38.158         0.974           46.34         55.66         0.66         32.168         0.961           50.54         49.46         11.02         27.966         0.9961           46.18         53.83         0.86         38.252         0.9963           36.36         63.64         0.57         31.061         0.4547           53.97         46.03         1.17         47.222         0.9955           46.15         58.85         0.86         38.18         0.9957           46.15         58.85         0.86         34.18         0.9995           46.15         59.51         0.98         38.118         0.9995           47.83         52.17         0.82         37.311         0.9995           45.53         54.47         0.84         39.371         0.9942           46.34         55.66         0.86         42.601         0.9961           50.54         49.46         1.02         27.966         0.9969           46.18         53.85         0.86         42.601         0.9969           46.18         53.85         0.86         27.966         0.9969           4	18,42         39,91         60.09         0.66         38.158         0.9704           13,98         50.54         45.46         0.86         42601         0.9991           13,98         50.54         49.46         1.02         27.96         0.9993           16,67         46.18         53.83         0.86         38.25         0.9958           16,78         36.36         63.64         0.57         31.061         0.9958           12,88         36.36         63.64         0.57         31.061         0.9958           16,24         46.15         53.85         0.86         34.188         0.9957           16,24         46.15         53.85         0.86         34.188         0.9957           19,87         50.05         49.95         1.00         37.444         1.0000           18,39         47.83         52.17         0.84         39.371         0.9966           18,47         39.91         60.09         0.66         38.158         0.704           13,98         45.53         54.47         0.84         39.371         0.9961           13,98         46.18         53.66         0.9999         0.966         38.158	19,74         18,42         39,91         60.09         0.66         38.158         0.9704           13,82         20,78         46.34         53.66         0.86         42601         0.9961           13,98         13,98         50.54         49.46         1.02         27.966         0.9961           18,15         16,67         46.18         53.83         0.86         38.25         0.9953           117,49         18,31         45.90         54.10         0.87         31.061         0.9953           17,49         18,31         45.90         54.10         0.85         35.792         0.9957           17,95         16,24         46.15         53.85         0.86         34.188         0.9957           17,55         16,24         46.15         53.85         0.86         34.188         0.9957           17,58         19,87         40.50         5.051         0.98         34.188         0.9957           117,58         18,39         47.83         52.17         0.92         37.311         0.9966           19,74         18,42         39.91         60.09         0.66         38.158         0.9961           13,98         13,98
		0.9961 0.9958 0.9958 0.9957 0.9957 0.9957 0.9999 1.0000 0.9942 0.9942	27.560 0.9999 38.252 0.9958 31.061 0.9457 37.722 0.9951 47.222 0.9957 34.188 0.9999 37.444 1.0000 37.311 0.9966 39.318 0.9942 27.566 0.9999 38.252 0.9958	1.02 27.956 0.9999 0.86 38.252 0.9958 0.87 37.92 0.9958 0.985 35.792 0.9957 0.986 38.016 0.9957 0.98 38.016 0.9995 0.986 38.016 0.9996 0.98 38.016 0.9996 0.98 42.601 0.9999 0.86 38.258 0.9999 0.86 38.258 0.9999 0.86 38.258 0.9958 0.57 0.57 0.9958 0.57 0.57 0.57 0.9958 0.57 0.57 0.9958 0.57 0.57 0.9958 0.57 0.57 0.9958 0.57 0.57 0.9958 0.57 0.57 0.9958 0.57 0.57 0.9958 0.57 0.57 0.9958 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.9958 0.57 0.57 0.9958 0.57 0.57 0.57 0.9958 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57	5.700         0.80         42.601         0.9990           49.46         1.02         27.596         0.9999           53.83         0.86         38.252         0.9958           63.64         0.57         31.72         0.9951           54.10         0.85         35.792         0.9951           65.85         0.86         34.188         0.9957           50.51         0.98         34.188         0.9957           50.51         0.98         37.444         1.000           52.17         0.92         37.444         1.000           60.09         0.66         38.158         0.9942           60.09         0.66         38.158         0.9942           40.46         1.02         27.956         0.9961           49.46         1.02         27.956         0.9968	46.34         49.46         1.02         42.60         0.9999           46.18         53.86         1.02         27.966         0.9999           46.18         53.83         0.86         38.252         0.9958           46.18         63.64         0.57         31.061         0.9958           45.90         54.10         0.85         35.792         0.9951           45.90         54.10         0.86         34.188         0.9957           46.15         53.85         0.86         34.188         0.9957           46.15         50.51         0.98         38.016         0.9995           47.83         52.17         0.92         37.41         0.9986           45.53         54.47         0.84         39.371         0.9986           46.34         53.66         0.86         38.188         0.9704           46.34         53.66         0.86         38.188         0.9965           46.18         53.81         0.9967         0.9986           46.18         53.81         0.9967         0.9986           46.18         53.81         0.9967         0.9967           46.18         53.83         0.9967 <td>20.78         46.54         53.40         0.86         42.001         0.9991           13.98         46.13         53.40         0.86         34.20         0.9999           16.67         46.18         53.83         0.86         38.25         0.9999           11.283         36.36         63.44         0.87         31.061         0.9457           12.83         45.90         54.10         0.85         35.792         0.9953           16.24         46.15         53.85         0.86         34.188         0.9957           16.24         46.15         53.85         0.86         34.188         0.9957           19.87         40.50         1.00         37.444         1.0000           118.36         47.83         52.17         0.92         37.311         0.9967           18.37         47.83         52.17         0.84         39.371         0.9967           18.42         39.91         60.09         0.66         38.158         0.704           13.98         50.54         49.46         1.02         27.956         0.9999           16.7         48.44         1.02         27.956         0.9999           16.7</td> <td>1.8.2         2.0.7.8         46.34         53.60         0.80         42.00         0.9991           13.98         13.98         50.54         49.46         1.02         27.956         0.9999           11.5         16.67         46.18         53.83         0.86         38.25         0.9958           18.18         12.88         36.36         63.4         0.57         31.061         0.9558           17.49         18.31         45.90         54.10         0.85         35.792         0.9951           17.95         16.24         46.13         1.17         47.222         0.9551           17.95         16.24         46.13         53.85         0.86         34.188         0.9957           17.56         19.63         49.50         50.51         0.98         34.188         0.9957           17.58         19.87         47.83         52.17         0.92         37.311         0.9986           18.39         47.83         52.17         0.92         37.311         0.9986           19.74         18.42         39.91         60.09         0.66         38.158         0.9051           13.98         13.98         50.44         10.2</td>	20.78         46.54         53.40         0.86         42.001         0.9991           13.98         46.13         53.40         0.86         34.20         0.9999           16.67         46.18         53.83         0.86         38.25         0.9999           11.283         36.36         63.44         0.87         31.061         0.9457           12.83         45.90         54.10         0.85         35.792         0.9953           16.24         46.15         53.85         0.86         34.188         0.9957           16.24         46.15         53.85         0.86         34.188         0.9957           19.87         40.50         1.00         37.444         1.0000           118.36         47.83         52.17         0.92         37.311         0.9967           18.37         47.83         52.17         0.84         39.371         0.9967           18.42         39.91         60.09         0.66         38.158         0.704           13.98         50.54         49.46         1.02         27.956         0.9999           16.7         48.44         1.02         27.956         0.9999           16.7	1.8.2         2.0.7.8         46.34         53.60         0.80         42.00         0.9991           13.98         13.98         50.54         49.46         1.02         27.956         0.9999           11.5         16.67         46.18         53.83         0.86         38.25         0.9958           18.18         12.88         36.36         63.4         0.57         31.061         0.9558           17.49         18.31         45.90         54.10         0.85         35.792         0.9951           17.95         16.24         46.13         1.17         47.222         0.9551           17.95         16.24         46.13         53.85         0.86         34.188         0.9957           17.56         19.63         49.50         50.51         0.98         34.188         0.9957           17.58         19.87         47.83         52.17         0.92         37.311         0.9986           18.39         47.83         52.17         0.92         37.311         0.9986           19.74         18.42         39.91         60.09         0.66         38.158         0.9051           13.98         13.98         50.44         10.2
		0.9958 0.9951 0.9951 0.9957 0.9959 1.0000 0.9942 0.9704	38.252 0.9958 31.061 0.9457 35.792 0.9951 34.188 0.9957 38.010 0.9993 37.444 0.9998 37.311 0.9942 38.158 0.9704 42.601 0.9961 27.956 0.9998 38.252 0.9958	0.86 38.252 0.9958 0.57 31.061 0.9457 0.85 35.792 0.9951 0.986 38.118 0.9957 0.9957 0.9957 0.9957 0.9957 0.9957 0.9958 0.9057 0.9958 0.9057 0.9958 0.9058 0.	53.83         0.86         38.252         0.9958           63.64         0.57         31.061         0.9457           54.10         0.85         35.792         0.9951           46.03         1.17         47.222         0.9951           55.85         0.86         34.188         0.9957           50.51         0.08         37.444         1.0000           52.17         0.92         37.341         0.9986           60.09         0.66         38.158         0.9704           60.09         0.66         38.158         0.9961           40.46         1.02         27.956         0.9969           53.83         0.86         38.222         0.9968	46.18         53.83         0.86         38.252         0.9568           45.90         54.10         0.57         31.061         0.9557           45.90         54.10         0.85         35.772         0.9951           46.15         53.85         0.10         34.188         0.9957           49.50         50.51         0.98         34.188         0.9957           47.22         60.99         1.00         37.44         1.0000           47.83         52.17         0.98         37.11         0.9986           45.53         54.47         0.84         39.371         0.9928           46.34         53.66         0.86         42.601         0.9961           46.34         53.66         0.86         42.601         0.9961           46.18         53.81         0.87         38.188         0.9704           46.18         53.83         0.86         32.25         0.9968           46.18         53.81         0.87         38.25         0.9968           46.18         53.82         0.86         38.25         0.9968           46.18         53.82         0.86         38.25         0.9968           46.1	16 67         46.18         53.83         0.86         38.252         0.9958           12.88         36.36         63.64         0.57         31.061         0.957           18.31         45.90         54.10         0.85         35.79         0.9955           16.24         46.13         53.87         46.03         1.17         47.222         0.9957           16.24         46.15         53.85         0.86         34.188         0.9957           19.63         49.50         55.15         0.98         34.188         0.9957           19.87         47.83         52.17         0.92         37.311         0.9986           18.36         47.83         52.17         0.94         39.371         0.9986           18.42         39.91         60.09         0.66         38.158         0.9704           13.98         50.54         49.46         1.02         27.956         0.9999           16.7         46.18         53.83         0.96         0.9999         0.965	21.50         16 67         46.18         53.83         0.86         38.252         0.958           17.49         12.88         36.36         63.64         0.57         31.061         0.957           17.49         18.31         45.90         54.10         0.85         35.792         0.9951           17.95         16.24         46.13         1.17         47.222         0.9957         0.9957           18.38         19.63         49.50         50.51         0.98         34.188         0.9957           18.38         19.87         50.05         50.51         0.98         38.016         0.999           18.99         18.39         47.83         52.17         0.92         37.341         0.9967           19.74         18.36         45.53         54.47         0.92         37.341         0.9961           19.74         18.42         39.91         60.09         0.66         38.158         0.961           13.98         13.98         50.44         10.02         27.966         0.9961           13.98         13.98         50.44         10.02         27.966         0.9961           13.98         13.98         50.86         38.252
		0.9457 0.9951 0.9957 0.9957 0.9959 1.0000 0.9942 0.9704	31.061 0.9457 35.792 0.9955 47.222 0.9955 38.016 0.9999 37.444 1.0000 37.311 0.9942 39.371 0.9942 42.601 0.9999 38.252 0.9958 31.061 0.9457	0.57 31.061 0.9457 0.85 35.722 0.9951 0.86 34.188 0.9957 0.98 38.016 0.9999 0.92 37.344 0.9986 0.92 37.344 0.9986 0.92 37.341 0.9986 0.86 38.158 0.9704 0.86 38.252 0.99986 0.86 38.252 0.9999 0.86 38.252 0.9958 0.57 31.061 0.9457 0.9457	63.64 0.57 31.061 0.9457 0.5460 0.55 35.701 0.9457 0.9561 0.86 35.702 0.9951 0.9051 0.	3.36         6.3.64         0.57         31.061         0.9457           45.90         54.10         0.85         35.702         0.9951           53.97         46.08         1.17         47.222         0.9951           49.50         50.51         0.88         34.188         0.9957           47.83         52.17         0.98         37.444         1.0000           45.53         54.17         0.82         37.14         0.9962           45.53         54.47         0.84         39.371         0.9942           46.34         56.09         0.66         38.188         0.9704           46.34         56.09         0.66         38.188         0.9704           46.34         56.09         0.66         38.188         0.9704           46.18         53.85         0.86         32.796         0.9961           46.18         53.83         0.86         38.252         0.9968           46.18         53.83         0.87         33.256         0.9968           46.18         53.83         0.87         31.061         0.9457	12.88         36.36         63.64         0.57         31.061         0.9457           18.31         45.90         54.10         0.85         35.792         0.9951           22.22         53.97         46.03         1.17         47.222         0.9951           16.24         46.15         58.85         0.86         34.188         0.9957           19.87         50.05         50.51         0.98         38.016         0.9999           19.87         50.05         52.17         0.92         37.414         1.000           18.39         47.83         52.17         0.84         39.371         0.9948           18.36         45.53         54.47         0.84         39.371         0.9948           18.42         39.31         60.09         0.66         38.158         0.9704           20.78         45.46         1.02         27.366         0.9999           13.98         50.54         49.46         1.02         27.366         0.9999           16.77         46.18         58.8         0.86         38.252         0.9999           16.7         48.46         1.02         27.366         0.9999           16.7	18.18   18.84   36.36   6.54   6.57   71.061   0.9457     17.49   18.31   45.90   54.10   0.85   35.722   0.9951     25.00   22.22   53.97   46.03   1.17   47.222   0.9951     18.38   19.63   49.50   50.51   0.98   38.10   0.9957     18.39   19.87   50.05   49.95   1.00   37.444   1.0000     18.92   18.39   47.83   52.17   0.98   37.311   0.9986     19.74   18.45   45.35   54.47   0.84   39.37   0.9961     19.74   18.45   46.34   53.66   0.86   38.158   0.9961     13.98   13.98   46.38   49.46   1.02   27.966   0.9969     21.59   16.67   46.18   53.83   0.86   38.252   0.9969     22.159   16.74   46.18   53.83   0.86   38.252   0.9969     23.85   24.85   24.85   24.85   0.9969     24.85   24.85   24.85   24.85   0.9969     25.85   26.78   46.18   53.83   0.86   38.252   0.9968     25.85   26.78   46.18   53.83   0.86   38.252   0.9968     25.85   26.78   26.78   26.78   26.78   0.9968     25.85   26.78   26.78   26.78   26.78   26.78     25.85   26.78   26.78   26.78   26.78   26.78     25.85   26.78   26.78   26.78   26.78   26.78     25.85   26.78   26.78   26.78   26.78   26.78     26.78   26.78   26.78   26.78   26.78   26.78     26.78   26.78   26.78   26.78   26.78   26.78     26.78   26.78   26.78   26.78   26.78   26.78     26.78   26.78   26.78   26.78   26.78     26.78   26.78   26.78   26.78   26.78     26.78   26.78   26.78   26.78     26.78   26.78   26.78   26.78     26.78   26.78   26.78   26.78     26.78   26.78   26.78   26.78     26.78   26.78   26.78   26.78     27.89   27.89   27.89     27.80   27.80   27.80     27.80   27.80   27.80     27.80   27.80   27.80     27.80   27.80   27.80     27.80   27.80   27.80     27.80   27.80   27.80     27.80   27.80
		0.9951 0.9955 0.9957 1.0000 0.9986 0.9942 0.9761	35.792 0.9955 147.222 0.9955 18.4 188 0.9955 23.4 188 0.9957 23.4 11.0000 23.7 31.1 0.9942 23.158 0.9958 27.956 0.9958 23.061 0.9457 33.061 0.9457	1.17 47.22 0.9955 1.00 0.955 1.00 0.955 1.00 0.955 1.00 0.955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.	54.10 0.85 35.792 0.9951 46.03 1.17 47.222 0.9955 1.05 53.85 0.86 34.188 0.9957 52.17 0.98 38.016 0.9999 52.17 0.84 39.371 0.998 0.00.09 0.66 38.188 0.9704 53.68 0.86 42.601 0.9961 49.46 1.102 27.956 0.9999 53.83 0.86 38.222 0.9958	45.90         64.10         0.85         35.792         0.9955           53.97         46.03         1.17         47.222         0.9955           46.15         58.85         0.86         34.188         0.9957           49.50         50.08         38.118         0.9995           50.05         49.95         1.00         37.444         1.0000           47.83         52.17         0.92         37.311         0.9942           45.53         54.47         0.84         39.371         0.9942           46.34         55.66         0.86         42.601         0.9942           50.54         49.46         1.02         27.96         0.9961           46.18         53.83         0.86         42.601         0.9961           46.18         53.83         0.86         27.966         0.9969           46.18         53.83         0.86         38.252         0.9968           46.18         53.83         0.86         27.966         0.9969           46.18         0.86         38.252         0.9968	18.31 45.90 54.10 0.85 35.792 0.9951 18.31 45.90 54.10 0.85 35.792 0.9955 16.24 46.15 53.85 0.86 34.188 0.9955 19.63 46.15 50.85 10.98 38.06 0.9955 19.87 46.03 1.17 47.22 0.9955 19.87 46.15 0.89 38.06 0.9999 19.87 46.15 0.99 10.98 38.06 0.9999 19.87 45.25 54.47 0.84 39.37 0.9942 18.42 39.91 60.09 0.66 38.158 0.9704 13.98 50.54 49.46 1.02 27.356 0.9999 10.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.86 38.25 0.9958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 11.67 46.18 53.83 0.958 0.958 11.67 46.18 53.83	17.49         18.31         45.90         54.10         0.85         35.792         0.9953           25.00         22.22         53.97         46.03         1.17         47.22         0.9955           17.95         16.24         46.15         53.85         0.86         34.188         0.957           17.56         19.87         46.15         53.85         0.86         34.188         0.957           17.58         19.87         46.15         50.51         0.98         38.06         0.995           18.92         18.39         47.83         52.17         0.92         37.311         0.996           18.42         45.53         54.47         0.84         39.371         0.996           19.74         18.42         39.91         60.09         0.66         38.158         0.704           13.98         13.98         50.54         49.46         10.2         27.366         0.9999           21.59         16.67         46.18         53.83         0.86         38.252         0.9958
		0.9955 0.9957 0.9999 1.0000 0.9986 0.9942 0.9704	34.722 0.9955 34.18 0.9957 38.016 0.9999 37.344 1.0000 37.31 0.9986 39.371 0.9942 42.601 0.9961 27.956 0.9999 38.252 0.9958	1.17 4.7.222 0.9955 0.86 34.122 0.9955 0.995 0.98 38.016 0.999 0.99 37.444 0.9996 0.92 37.341 0.9986 0.96 38.158 0.9704 0.86 38.158 0.9704 0.86 38.25 0.9999 0.86 38.25 0.9958 0.57 0.57 0.95	54.603 1.17 47.225 0.9955 54.85 0.8955 64.95 0.86 34.188 0.9957 64.95 1.00 37.444 1.0000 0.66 38.188 0.9986 6.0.99 0.66 38.188 0.9951 60.09 0.66 38.188 0.9951 69.46 1.02 27.956 0.9999 53.83 0.86 38.222 0.9958	5.3.97         46.03         1.17         47.225         0.9955           46.15         53.85         1.17         47.225         0.9957           49.50         50.51         0.98         38.016         0.9997           47.83         52.17         0.92         37.431         0.9986           45.53         54.47         0.84         39.371         0.9986           46.34         53.66         0.66         38.158         0.9704           46.34         53.66         0.86         42.601         0.9961           46.18         53.83         0.86         38.222         0.9658           46.18         53.83         0.86         38.222         0.9958           46.18         53.83         0.86         38.222         0.9958           46.18         53.64         0.57         31.061         0.9457	22.22 53.97 46.03 1.17 47.222 0.9955 16.24 46.13 53.85 0.86 34.188 0.9957 16.24 46.15 53.85 0.86 34.188 0.9957 19.63 49.50 5.051 0.98 34.188 0.9957 19.87 50.05 49.95 10.92 37.311 0.9967 18.36 45.53 54.47 0.84 39.37 0.995 18.42 39.31 60.09 0.66 38.158 0.9704 13.98 50.54 49.46 1.02 27.956 0.9999 16.67 46.18 53.85 0.86 38.252 0.9958 10.00	25.00 22.22 53.97 46.03 1.17 47.222 0.9955 17.95 16.24 46.13 53.85 0.86 34.188 0.9957 17.95 16.24 46.15 53.85 0.86 34.188 0.9957 18.38 19.63 49.50 50.51 0.98 38.016 0.9999 18.39 47.83 52.17 0.92 37.344 1.0096 18.92 18.36 47.83 52.17 0.92 37.341 0.9986 19.74 18.36 45.53 54.47 0.84 39.371 0.9986 19.74 18.42 39.91 60.09 0.66 38.158 0.9704 13.98 13.98 50.54 46.14 53.65 0.86 38.158 0.9991 13.98 13.98 13.98 50.54 46.18 53.83 0.86 38.252 0.9958
	55		38.016 37.444 37.311 39.131 38.158 42.601 27.956 38.252 31.061	0.98 38.016 0.98 37.444 0.92 37.31 0.66 38.158 0.86 42.601 1.02 57.956 0.86 38.252 0.57 31.061	50.51 0.98 38.016 49.95 1.00 37.444 52.17 0.92 37.311 60.09 0.66 38.18 53.66 0.86 42.601 49.46 1.02 27.966 53.83 0.86 38.252	49.50 50.51 0.08 38.105 6.05 5.05 5.05 5.05 5.05 5.05 5.05 5.	19.63 49.50 50.51 0.38 38.016 19.87 50.05 49.95 1.00 37.444 18.39 45.53 52.17 0.92 37.311 18.42 39.91 60.09 0.66 38.158 20.78 46.34 53.66 0.86 42.601 13.98 50.54 49.46 1.02 27.956 11.67 46.18 53.83 0.86 38.252	18.38         19.63         49.50         50.51         0.98         38.016           17.58         19.87         50.05         49.56         1.00         37.444           18.92         47.83         52.17         0.92         37.444           21.01         18.36         45.53         54.47         0.92         37.31           21.82         20.78         46.34         60.09         0.66         38.158           21.82         20.78         46.34         53.66         0.86         42.601           21.89         10.67         46.18         53.83         0.86         38.252
	- 66		37.444 37.311 39.371 38.158 42.601 27.956 38.252	0.92 37.444 0.92 37.311 0.84 38.758 0.66 38.158 0.86 42.601 1.02 37.956 0.86 38.252 0.57 31.061	49.95     1.00     37.444       52.17     0.92     37.311       54.47     0.84     39.371       60.09     0.66     38.158       53.66     0.86     27.901       49.46     1.02     27.956       53.83     0.86     38.252	50.05         40.95         1.00         37.444           47.83         52.17         0.92         37.311           45.53         54.47         0.89         37.371           39.91         60.09         0.66         38.158           46.34         53.66         0.86         42.601           50.54         49.46         1.02         27.96           46.18         53.83         0.86         38.252           36.36         63.64         0.57         31.061	19.87         50.05         49.95         1.00         37.444           18.39         47.83         52.17         0.92         37.311           18.36         45.53         54.47         0.84         39.371           18.42         39.91         60.09         0.66         38.158           20.78         46.34         53.66         0.86         42.601           13.98         50.54         49.46         1.02         27.366           16.67         46.18         53.83         0.86         38.552	17.58         19.87         50.05         49.95         1.00         37.444           18.92         18.39         47.83         52.17         0.92         37.311           21.01         18.36         45.53         54.47         0.84         39.311           19.74         18.42         39.91         60.09         0.66         38.158           21.82         20.78         46.34         53.66         0.86         42.601           21.59         16.67         46.18         53.83         0.86         38.252
	00		37.311 39.371 38.158 42.601 27.956 38.252 31.061	0.92 37.311 0.84 39.371 0.66 38.158 0.86 42.601 1.02 27.956 0.86 38.252 0.57 31.061	52.17 0.92 37.311 54.47 0.84 39.371 60.09 0.66 38.158 53.66 0.86 42.601 49.46 1.02 27.566 53.83 0.86 38.252	47.83         52.17         0.92         37.311           45.53         54.47         0.84         39.371           39.91         60.09         0.66         38.158           46.34         53.66         0.86         42.601           50.54         49.46         1.02         27.966           46.18         53.83         0.86         38.252           36.36         63.64         0.57         31.061	18.39 47.83 52.17 0.92 37.311 18.36 45.53 54.47 0.84 39.371 18.42 39.91 60.09 0.66 38.185 20.78 46.18 53.66 0.86 42.601 13.98 50.54 49.46 1.02 27.566 16.67 46.18 58.83 0.86 38.252	18.92         18.39         47.83         52.17         0.92         37.311           18.10         18.36         45.53         54.47         0.84         39.31           19.74         18.42         39.91         60.09         0.66         38.188           21.82         20.78         46.34         53.66         0.86         42.601           13.98         50.54         49.46         1.02         27.566           21.59         16.67         46.18         53.83         0.86         38.252
	98		39.371 38.158 42.601 27.956 38.252 31.061	0.84 38.373 0.66 38.158 0.86 42.601 0.86 38.252 0.57 31.061	54.47 0.84 39.371 60.09 0.66 38.158 53.66 0.86 42.601 449.46 1.02 27.956 53.83 0.86 38.252	45.53         56.47         0.84         39.371           45.51         60.09         0.66         38.18           46.34         53.66         0.86         42.601           50.54         49.46         1.02         27.966           46.18         53.83         0.86         38.222           36.36         63.64         0.57         31.061	18.36 45.53 54.47 0.84 39.371 18.42 39.91 60.09 0.66 38.158 20.78 46.34 53.66 0.86 42.601 13.98 50.54 49.46 1.02 27.956 11.667 46.18 53.83 0.86 38.252 10.667 60.84 0.85	21.01         18.36         45.53         54.47         0.84         39.31           21.82         20.78         46.34         60.09         0.66         38.158           21.82         20.78         46.34         53.66         0.86         42.601           13.98         13.98         15.59         49.46         1.02         27.966           21.59         16.67         46.18         53.83         0.86         38.252
	42		38.158 42.601 27.956 38.252 31.061	0.66 38.158 0.86 42.601 1.02 27.956 0.86 38.252 0.57 31.061	60.09 0.66 38.158 53.66 0.86 42.601 49.46 1.02 27.956 53.83 0.86 38.252	39,91 60,09 0.66 38.188 46,34 53.66 0.86 42,601 50,54 49,46 1.02 27,966 46.18 53.83 0.86 38.252 36.36 63.64 0.57 31.061	18.42 39.91 60.09 0.66 38.158 10.78 46.34 53.66 0.86 42.601 13.98 50.54 49.46 1.02 27.956 11.67 46.18 53.83 0.86 38.252 11.00 0.00 0.00 0.00 0.80	19,74 18,42 39,91 60.09 0.66 38,158 12,82 20,78 46,34 53.66 0.86 42,601 13,98 13,98 50,54 49,46 1.02 27,956 21,59 16,67 46,18 53,83 0.86 38,252
	94		42.601 27.956 38.252 31.061	0.86 42.601 1.02 27.956 0.86 38.252 0.57 31.061	53.66 0.86 42.601 49.46 1.02 27.956 53.83 0.86 38.252	46.34 53.66 0.86 42.601 50.54 49.46 1.02 27.956 46.18 53.83 0.86 38.252 36.36 63.64 0.57 31.061	20.78 46.34 53.66 0.86 42.601 13.98 50.54 49.46 1.02 27.556 16.67 46.18 83 0.86 38.252 10.00 0.00 0.00 0.00 0.00	21.82 20.78 46.34 53.66 0.86 42.601 13.98 13.98 50.54 49.46 1.02 27.556 21.59 16.67 46.18 53.83 0.86 38.252
0.9895	61		27.956 38.252 31.061	1.02 27.956 0.86 38.252 0.57 31.061	49.46 1.02 27.956 53.83 0.86 38.252	50.54 49.46 1.02 27.956 46.18 53.83 0.86 38.252 36.36 63.64 0.57 31.061	13.98 50.54 49.46 1.02 27.956 1.05 46.18 53.83 0.86 38.252 1.00 96.96 69.64 91.05	13.98 13.98 50.54 49.46 1.02 27.956 21.59 16.67 46.18 53.83 0.86 38.252
0.9274	66		38.252 31.061	0.86 38.252 0.57 31.061	53.83 0.86 38.252	46.18     53.83     0.86     38.252       36.36     63.64     0.57     31.061	16.67 46.18 53.83 0.86 38.252	21.59 16.67 46.18 53.83 0.86 38.252
	00 1		31.061	0.57 31.061	100000000000000000000000000000000000000	36.36 63.64 0.57 31.061	20 20 20 20 20 20 20 20 20 20 20 20 20 2	.00 .00 .00 .00 .00 .00
0.9180	212	36.066 0.9951	36.066	36.066	54.10 0.85 36.066	45.90 54.10 0.85 36.066	12.55 50.50 65.64 0.57 51.001 18.31 45.90 54.10 0.85 36.066	18.18 12.88 50.30 03.04 0.57 31.001 17.76 18.31 45.90 54.10 0.85 36.066
	10			1.17 47.063	1.17 47.063	53.97 46.03 1.17 47.063	22.22 53.97 46.03 1.17 47.063	24.84 22.22 53.97 46.03 1.17 47.063
0.9610	10		34.188	34.188	53.85 0.86 34.188	46.15 53.85 0.86 34.188	16.24 46.15 53.85 0.86 34.188	17.95 16.24 46.15 53.85 0.86 34.188
	6	38.006 0.9999		0.98 38.006	0.98 38.006	49.51 50.49 0.98 38.006	19.64 49.51 50.49 0.98 38.006	18.37 19.64 49.51 50.49 0.98 38.006
0.9762	$\approx$		37.44	1.00 37.44	49.95 1.00 37.44	50.05 49.95 1.00 37.44	19.87 50.05 49.95 1.00 37.44	17.57 19.87 50.05 49.95 1.00 37.44
0.9757	š		37.337	0.92 37.337	52.17 0.92 37.337	47.83 52.17 0.92 37.337	18.42 47.83 52.17 0.92 37.337	18.92 18.42 47.83 52.17 0.92 37.337
9086.0	4		39.371	0.84 39.371	54.47 0.84 39.371	45.53 54.47 0.84 39.371	18.36 45.53 54.47 0.84 39.371	21.01 18.36 45.53 54.47 0.84 39.371
0.9583	74		38.158	0.66 38.158	60.09 0.66 38.158	39.91 60.09 0.66 38.158	18.42 39.91 60.09 0.66 38.158	19.74 18.42 39.91 60.09 0.66 38.158
	51	42.601 0.9961	42.601	0.86 42.601	53.66 0.86 42.601 (	46.34 53.66 0.86 42.601 (	20.78 46.34 53.66 0.86 42.601 (	21.82 20.78 46.34 53.66 0.86 42.601 (
	66	0	27.956	1.02 27.956	49.46 1.02 27.956 (	50.54 49.46 1.02 27.956 (	13.98 50.54 49.46 1.02 27.956 (	13.98 13.98 50.54 49.46 1.02 27.956 (
0.9772 0.88	28	_	_	0.86 38.252 (	53.83 0.86 38.252 (	46.18 53.83 0.86 38.252 (	16.67 46.18 53.83 0.86 38.252 (	21.59 16.67 46.18 53.83 0.86 38.252 (
Ī	24	0	31.061 0	0.57 31.061 0	63.64 0.57 31.061 0	36.36 63.64 0.57 31.061 0	12.88 36.36 63.64 0.57 31.061 0	18.18 12.88 36.36 63.64 0.57 31.061 0
	21	0	35.792 0	0.85 35.792 0	0.85 35.792 0	45.90 54.10 0.85 35.792 0	18.31 45.90 54.10 0.85 35.792 0	17.49 18.31 45.90 54.10 0.85 35.792 0
	55	0	47.222 0	1.17 47.222 0	46.03 1.17 47.222 0	53.97 46.03 1.17 47.222 0	22.22 53.97 46.03 1.17 47.222 0	25.00 22.22 53.97 46.03 1.17 47.222 0
	24			34.188	53.85 0.86 34.188	46.15 53.85 0.86 34.188	16.24 46.15 53.85 0.86 34.188	17.95 16.24 46.15 53.85 0.86 34.188
-	66	37.952 0.9999	37.952	0.98 37.952	50.45 0.98 37.952	49.53 50.45 0.98 37.952	19.60 49.53 50.45 0.98 37.952	18.35 19.60 49.53 50.45 0.98 37.952

Table 5: MERS, HKU1,  $\alpha$ -CoV-1 and  $\beta$ -CoV-1] Genes and their associated genomes with quantitative features

0.000000000000000000000000000000000000	% beS	(A) %	(T)	(C)	% (G)	(%) Pu	(%) Py	Pu/Py	% (GC)	B_S	Con_S	S_A	S_C	S_G	S_T	B_E	H_A	H_C	H_G	H_T
25.04         34.12         21.4         1.6.6         55.54         0.80         40.74         0.9911         0.9822         0.81           25.00         34.94         2.4.4         1.6.3         44.6         55.54         0.80         40.06         0.9843         0.81           26.00         29.7         23.94         20.30         46.36         55.64         0.86         44.24         0.9952         0.9933         0.83           21.04         38.67         23.86         16.48         37.48         6.25         0.07         40.3         0.9957         0.9933         0.82           21.04         38.67         20.21         21.52         46.21         57.09         0.86         47.25         0.9957         0.9963         0.74           25.24         31.67         20.23         47.18         6.25         0.09         47.25         0.9957         0.9960         0.87           26.21         31.67         20.23         47.18         6.27         40.34         6.27         0.996         0.997         0.996           27.28         32.60         20.25         40.24         6.28         47.25         0.996         0.996           26.21			3.65	19.35	21.56	48.00	52.00	0.92	40.9	0.9988	0.9852	0.83	0.71	0.75	0.91	0.59	0.58	0.54	0.54	0.58
25.00         34.94         22.44         17.63         42.63         57.37         0.74         40.06         0.9843         0.9776         0.83           25.06         34.94         22.44         17.68         45.65         0.77         41.57         0.9843         0.83           25.70         32.66         23.89         17.68         43.46         56.55         0.77         41.57         0.9845         0.83           25.70         33.67         23.89         17.68         43.46         56.59         0.87         39.76         0.9843         0.88           27.78         33.30         20.12         21.28         47.89         0.86         47.25         0.9957         0.9969         0.83           28.28         32.40         10.78         47.89         0.88         47.18         0.9957         0.9969         0.88           28.28         32.40         10.78         47.89         6.07         47.28         0.9944         0.88         0.82           28.28         32.70         10.84         42.28         6.107         0.84         47.28         0.9944         0.88         0.88           25.24         47.28         47.11         0.84			1.12	21.42	19.33	44.46	55.54	0.80	40.74	0.9911	0.9822	0.81	0.75	0.71	0.93	09.0	0.57	0.56	09.0	0.61
26.06         29.70         23.94         20.30         46.36         53.64         0.86         44.24         0.9962         0.9933         0.82           25.70         32.66         23.84         17.48         55.64         0.67         40.3         0.0842         0.82           21.04         38.67         23.85         16.44         37.48         55.52         0.60         40.3         0.9927         0.9923         0.74           24.70         34.54         20.48         19.28         44.98         55.03         0.98         41.18         0.9927         0.9909         0.82           24.70         31.67         22.00         47.89         48.22         51.78         0.93         41.18         0.9977         0.9973         0.997           25.24         47.46         13.61         13.94         48.22         51.78         0.93         41.18         0.997         0.986         0.88           26.21         47.66         13.64         48.22         51.78         0.93         41.18         0.997         0.982         0.88           27.21         47.66         13.64         48.22         51.78         0.93         41.18         0.994         0.994			1.94	22.44	17.63	42.63	57.37	0.74	40.06	0.9843	0.9776	0.81	0.77	0.67	0.93	0.63	09.0	0.59	0.55	0.58
2.5.78         3.2.66         3.2.66         4.0.3         0.77         4.1.57         0.8976         0.9934         0.82           2.1.0         3.2.67         23.89         17.68         43.46         56.55         0.67         40.3         0.9543         0.74           2.1.0         34.54         20.48         110.28         44.98         55.02         0.82         39.76         0.9957         0.9950         0.74           2.7.3         20.03         20.23         20.03         47.16         52.84         0.89         47.12         0.9997         0.9960         0.87           2.8.28         39.74         12.05         19.34         48.25         51.73         0.9997         0.9960         0.88           2.8.28         39.74         12.06         18.56         40.16         52.84         0.89         41.17         0.9944         0.82         36.82           2.5.24         47.46         18.56         40.16         52.84         0.89         41.17         0.89         0.99         0.88         36.89         0.88         36.89         0.107         0.89         41.18         0.89         0.88         36.89         0.107         0.89         41.89         0.	_		3.70	23.94	20.30	46.36	53.64	98.0	44.24	0.9962	0.9933	0.83	0.79	0.73	0.88	0.62	0.59	0.54	0.64	0.64
2.1.04         3.8.67         16.44         27.48         62.52         0.60         40.3         0.9543         0.92923         0.74           25.7.0         34.54         20.38         49.28         55.79         0.82         39.76         0.9957         0.9903         0.82           24.7.0         31.67         22.12         46.21         53.79         0.86         43.64         0.9957         0.9903         0.82           27.88         32.30         20.71         47.89         49.03         0.98         41.18         0.9977         0.9903         0.82           28.28         32.30         20.01         47.89         57.11         0.83         41.25         0.9947         0.9960         0.83           28.28         32.70         47.64         13.61         13.44         16.68         42.89         57.11         0.75         31.17         0.9842         0.82           25.24         47.46         13.60         40.16         59.84         0.67         37.13         0.9943         0.82           25.24         47.46         13.60         40.16         59.84         0.67         37.14         0.9943         0.82           25.30         42.26 </th <th>_</th> <th></th> <th>3.66</th> <th>23.89</th> <th>17.68</th> <th>43.46</th> <th>56.55</th> <th>0.77</th> <th>41.57</th> <th>0.9876</th> <th>0.9834</th> <th>0.82</th> <th>0.79</th> <th>0.67</th> <th>0.91</th> <th>0.54</th> <th>0.51</th> <th>0.52</th> <th>0.57</th> <th>0.57</th>	_		3.66	23.89	17.68	43.46	56.55	0.77	41.57	0.9876	0.9834	0.82	0.79	0.67	0.91	0.54	0.51	0.52	0.57	0.57
25.70         34.54         20.48         19.28         44.98         55.02         0.82         39.76         0.9952         0.91799         0.82           24.78         314.54         20.48         19.28         44.98         55.02         0.86         43.64         0.9952         0.9919         0.81           27.88         23.30         20.57         20.01         47.89         49.03         0.98         47.25         0.9977         0.9959         0.83           28.28         39.74         12.05         19.34         48.25         51.84         0.89         41.18         0.9997         0.9960         0.86           26.21         42.26         14.59         18.50         45.76         51.87         0.9944         0.882         0.83           26.49         46.99         18.55         20.30         45.76         51.81         0.84         47.85         0.9944         0.88         0.83           26.49         47.18         55         48.19         51.81         0.93         31.07         0.9948         0.916         0.88           26.49         47.18         55         48.19         56.84         34.34         0.9944         0.88         0.83			3.67	23.85	16.44	37.48	62.52	0.60	40.3	0.9543	0.9623	0.74	0.79	0.64	96.0	0.49	0.55	09.0	0.48	0.54
2.4.70         31.67         20.86         43.64         0.9957         0.9910         0.81           27.88         23.30         25.73         20.03         47.16         52.84         0.86         47.15         0.9959         0.9910         0.81           26.23         32.60         20.25         20.03         47.16         52.84         0.89         41.18         0.9957         0.9950         0.891           26.23         32.60         20.25         20.03         47.16         52.84         0.89         41.18         0.9957         0.9950         0.83           26.21         47.46         18.65         20.33         61.77         0.75         31.17         0.9954         0.9054         0.82           26.21         47.24         18.55         40.16         59.84         0.67         31.17         0.9954         0.902         0.83           26.40         46.99         47.17         0.75         32.44         0.9954         0.902         0.83           26.41         31.07         48.86         51.81         0.93         44.24         0.98         0.99         0.99         0.88           27.84         40.10         48.88         50.44			1.54	20.48	19.28	44.98	55.02	0.82	39.76	0.9927	0.9799	0.82	0.73	0.71	0.93	0.55	0.57	0.61	0.55	0.61
26.28         23.30         20.01         47.89         49.03         0.98         47.25         0.9977         0.9950         0.87           26.28         32.30         20.25         20.33         47.16         52.84         0.89         41.18         0.9977         0.9950         0.83           28.28         39.74         12.05         19.94         48.22         51.78         0.98         41.18         0.9944         0.8890         0.83           25.24         13.61         13.70         38.93         61.07         31.17         0.9844         0.8980         0.83           25.40         46.99         12.85         15.26         40.16         59.44         0.84         31.77         32.44         0.82           25.30         47.26         14.29         15.26         40.16         59.44         0.84         37.20         0.9944         0.82           25.30         48.19         16.65         51.81         0.93         44.34         0.9972         0.9949         0.83           25.30         49.10         48.86         51.12         0.77         32.44         0.984         0.994         0.88           28.46         49.10         48.88			1.67	22.12	21.52	46.21	53.79	98.0	43.64	0.9959	0.9910	0.81	0.76	0.75	06.0	0.63	09.0	0.53	0.59	0.65
26.23         32.60         20.25         20.93         47.16         0.89         41.18         0.9977         0.9862         0.88           28.28         32.64         12.05         19.94         48.25         51.78         0.991         0.9977         0.9862         0.86           25.24         47.46         13.61         13.74         48.25         51.71         0.64         27.3         0.9944         0.882         0.86           25.24         47.46         13.61         13.74         38.93         61.07         0.64         27.3         0.9944         0.882         0.82           25.40         46.99         16.85         40.16         59.84         0.67         28.48         0.9943         0.9029         0.82           25.40         41.07         22.44         0.84         34.85         0.9943         0.929         0.82           25.40         41.07         13.44         0.094         35.44         0.997         0.982         0.88           25.41         40.01         13.66         48.16         51.94         0.93         32.06         0.994         0.88         32.06         0.88           27.54         40.01         13.62			3.30	25.73	20.01	47.89	49.03	86.0	47.25	0.9997	0.9950	0.87	0.82	0.75	0.78	0.56	09.0	0.54	0.56	0.53
28.28         39.74         12.05         19.94         48.22         51.78         0.93         31.99         0.9991         0.3880         0.86           25.24         47.64         13.61         13.70         38.93         61.77         0.64         27.3         0.6944         0.889         0.82           26.21         42.62         14.49         16.68         42.89         57.11         0.75         31.77         0.9844         0.8948         0.9516         0.82           25.40         46.99         12.85         45.76         55.5         0.77         28.11         0.9948         0.9516         0.82           25.30         41.26         15.94         0.67         28.11         0.9949         0.9972         0.81           25.40         42.26         15.44         0.984         0.67         28.14         0.9972         0.9940         0.83           28.43         32.91         16.66         21.50         46.88         53.12         0.88         32.06         0.9992         0.9944         0.88           28.84         32.91         16.66         21.56         50.22         0.99         38.212         0.9994         0.88           29.77			3.60	20.25	20.93	47.16	52.84	0.89	41.18	0.9977	0.9862	0.83	0.73	0.74	0.91	0.65	0.58	99.0	0.63	0.64
25.24         47.46         13.61         13.70         38.93         61.07         0.64         27.3         0.9644         0.8880         0.82           26.24         47.46         16.66         42.89         57.11         0.75         31.17         0.9854         0.83           25.46         39.70         14.55         20.30         45.76         54.24         0.84         34.85         0.97         0.9084         0.937           25.40         42.90         18.55         48.19         51.81         0.93         48.99         0.93         0.93         0.9848         0.937         0.987         0.909         0.82           25.40         42.26         14.29         18.55         48.19         51.81         0.93         44.34         0.99         0.9942         0.987         0.88           28.16         27.51         24.44         46.88         53.12         0.86         32.02         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.98         0.98         0.98         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.99         0.9			3.74	12.05	19.94	48.22	51.78	0.93	31.99	0.9991	0.9380	98.0	0.53	0.72	0.97	0.62	0.62	0.63	0.59	99.0
26.21         42.62         14.49         16.68         42.89         57.11         0.75         31.17         0.8554         0.9228         0.82           25.40         46.99         14.26         20.30         45.71         0.67         38.48         0.9948         0.9518         0.82           24.30         46.99         12.85         15.26         40.16         59.84         0.67         28.11         0.9948         0.9179         0.9029         0.81           25.30         42.26         14.29         18.16         48.16         51.94         0.63         39.29         0.9971         0.9029         0.81           25.44         40.10         13.02         19.90         48.06         51.94         0.93         39.29         0.9874         0.88           27.84         40.10         13.02         19.90         48.06         51.94         0.93         38.20         0.998         0.998         0.88           28.88         32.91         16.66         21.65         49.57         1.02         0.88         32.06         0.998         0.998         0.998         0.88           28.74         31.53         16.67         21.44         0.93         38.204 <th></th> <th></th> <th>7.46</th> <th>13.61</th> <th>13.70</th> <th>38.93</th> <th>61.07</th> <th>0.64</th> <th>27.3</th> <th>0.9644</th> <th>0.8980</th> <th>0.82</th> <th>0.57</th> <th>0.58</th> <th>1.00</th> <th>0.61</th> <th>0.56</th> <th>0.63</th> <th>0.58</th> <th>0.64</th>			7.46	13.61	13.70	38.93	61.07	0.64	27.3	0.9644	0.8980	0.82	0.57	0.58	1.00	0.61	0.56	0.63	0.58	0.64
2.5.46         39.70         14.55         20.30         45.76         54.24         0.84         34.85         0.9948         0.9016         0.82           25.40         46.99         12.85         15.26         40.16         59.84         0.677         28.11         0.9719         0.9020         0.81           25.30         42.26         14.29         18.16         43.45         56.55         0.77         32.44         0.988         0.9981         0.9928         0.81           28.16         27.51         24.43         19.04         46.88         53.12         0.88         32.06         0.9982         0.988         0.88           28.84         32.91         16.66         21.55         50.43         49.78         1.02         38.212         0.9992         0.9944         0.88           29.77         31.97         18.25         20.02         48.36         50.22         0.99         38.244         0.99         0.99         0.967         0.88           29.77         31.97         18.91         47.34         50.22         0.99         38.244         0.99         0.99         0.99         0.99         0.967         0.88           29.75         31.19			3.62	14.49	16.68	42.89	57.11	0.75	31.17	0.9854	0.9328	0.83	09.0	0.65	86.0	0.55	0.58	09.0	0.58	0.54
24,90         46,99         15,26         40,16         59,84         0,67         22,41         0,971         0,929         0,81           25,30         42,26         12,85         18,16         48,19         18,18         0,67         39,24         0,997         0,992         0.82           29,64         31,07         20,44         18,55         48,19         51,81         0,03         39,29         0,991         0,982         0.82           28,16         27,51         24,43         19,50         48,86         51,94         0,98         34,99         0,997         0.88           27,84         40,10         13,02         20,43         49,57         1,02         38,216         0,997         0,994         0.88           29,77         31,97         18,25         20,43         49,57         1,02         0,899         0,997         0,88           29,77         31,97         18,26         48,36         51,64         0,94         37,08         0,999         0,974         0,88           28,43         36,56         46,09         37,04         0,94         37,04         0,98         0,99         0,99         0,88           28,43         31,			9.70	14.55	20.30	45.76	54.24	0.84	34.85	0.9948	0.9516	0.82	09.0	0.73	0.97	0.58	0.56	0.58	0.62	09.0
25.30         42.26         14.29         18.16         43.45         56.55         0.77         32.44         0.9876         0.9374         0.88           25.30         41.26         18.16         48.45         56.55         0.77         32.44         0.9876         0.9878         0.88           28.16         27.51         24.43         19.90         48.06         51.94         0.98         44.34         0.9989         0.9937         0.86           28.88         32.91         16.66         21.55         50.43         49.78         50.22         0.99         38.212         0.9993         0.9764         0.85           29.77         31.97         18.25         20.02         49.78         50.22         0.99         38.212         0.9963         0.9764         0.85           29.77         31.97         18.25         20.02         40.78         50.20         0.99         0.99         0.99         0.97         0.84           29.77         36.15         16.11         18.91         47.34         52.66         0.90         35.34         0.99         0.99         0.99         0.83           28.43         36.16         19.10         46.40         1.16			3.99	12.85	15.26	40.16	59.84	0.67	28.11	0.9719	0.9029	0.81	0.55	0.62	1.00	0.69	0.67	0.61	0.54	0.72
29.64         31.07         18.55         48.19         51.81         0.93         39.29         0.9991         0.92828         0.88           28.16         27.51         24.43         19.04         48.06         51.81         0.93         44.34         0.99891         0.99288         0.88           27.84         40.10         13.02         19.04         46.88         53.12         0.88         32.06         0.99991         0.9977         0.86           29.77         31.97         18.25         20.04         48.36         51.64         0.94         38.264         0.9999         0.9744         0.88           29.77         31.97         18.25         20.04         48.36         51.64         0.94         38.264         0.9992         0.9742         0.88           29.77         31.53         14.89         16.04         48.36         51.64         0.94         38.264         0.9992         0.977         0.88           26.51         38.15         16.04         48.36         51.64         0.94         37.04         0.9982         0.93           27.52         32.24         19.24         48.34         51.64         0.94         37.04         0.9982 <td< th=""><th></th><th></th><th>2.26</th><th>14.29</th><th>18.16</th><th>43.45</th><th>56.55</th><th>0.77</th><th>32.44</th><th>0.9876</th><th>0.9374</th><th>0.82</th><th>0.59</th><th>89.0</th><th>86.0</th><th>0.64</th><th>0.56</th><th>0.58</th><th>0.62</th><th>99.0</th></td<>			2.26	14.29	18.16	43.45	56.55	0.77	32.44	0.9876	0.9374	0.82	0.59	89.0	86.0	0.64	0.56	0.58	0.62	99.0
28.16         27.51         24.43         19.90         48.06         51.94         0.93         44.34         0.9889         0.9937         0.86           27.84         40.10         13.02         19.04         46.88         53.12         0.88         32.06         0.9989         0.9937         0.86           28.88         32.91         16.02         21.04         46.88         53.12         0.999         0.9092         0.9764         0.85           28.77         36.15         16.97         21.02         48.78         50.22         0.99         38.212         0.9992         0.9774         0.85           26.74         36.15         16.97         49.78         50.22         0.99         38.212         0.9962         0.9774         0.88           26.74         36.15         16.97         46.40         1.16         31.532         0.9962         0.9777         0.98           26.51         38.15         16.67         48.81         51.20         0.95         4.0         0.998         0.998         0.9377         0.98           26.54         38.16         11.16         21.26         48.81         51.20         0.99         0.99         0.99         0.99 </th <th></th> <th></th> <th>1.07</th> <th>20.74</th> <th>18.55</th> <th>48.19</th> <th>51.81</th> <th>0.93</th> <th>39.29</th> <th>0.9991</th> <th>0.9828</th> <th>0.88</th> <th>0.74</th> <th>69.0</th> <th>68.0</th> <th>0.55</th> <th>09.0</th> <th>0.64</th> <th>0.57</th> <th>0.65</th>			1.07	20.74	18.55	48.19	51.81	0.93	39.29	0.9991	0.9828	0.88	0.74	69.0	68.0	0.55	09.0	0.64	0.57	0.65
2.7.84         40.10         13.02         19.04         46.88         53.12         0.88         32.06         0.9997         0.9444         0.85           28.88         32.91         16.66         21.55         50.43         49.78         10.02         38.212         0.9997         0.9464         0.87           29.77         31.97         18.25         20.02         49.78         50.22         0.99         38.214         0.9992         0.9767         0.88           29.77         31.97         18.25         20.02         49.78         50.22         0.99         38.264         10.000         0.9774         0.88           36.94         31.57         16.11         18.91         47.34         52.66         0.90         35.042         0.9962         0.9677         0.88           26.51         38.15         16.01         18.91         47.34         52.66         0.90         35.042         0.9982         0.9972         0.98           27.55         32.45         16.41         18.8         48.11         51.20         0.96         35.342         0.9982         0.93           27.55         32.41         22.22         48.81         51.20         0.96 <td< th=""><th></th><th></th><th>7.51</th><th>24.43</th><th>19.90</th><th>48.06</th><th>51.94</th><th>0.93</th><th>44.34</th><th>0.9989</th><th>0.9937</th><th>98.0</th><th>0.80</th><th>0.72</th><th>0.85</th><th>0.59</th><th>0.65</th><th>0.57</th><th>0.58</th><th>0.54</th></td<>			7.51	24.43	19.90	48.06	51.94	0.93	44.34	0.9989	0.9937	98.0	0.80	0.72	0.85	0.59	0.65	0.57	0.58	0.54
28.88         32.91         16.66         21.55         50.43         49.57         1.02         38.212         0.9999         0.9765         0.87           29.77         31.97         18.25         20.15         49.57         51.62         0.99         38.284         0.0999         0.9765         0.88           26.74         31.53         16.49         21.60         48.36         51.64         0.94         38.284         0.0999         0.9776         0.88           26.74         31.53         16.67         16.77         46.40         1.16         31.532         0.9962         0.9777         0.85           28.43         36.56         16.11         18.14         47.44         21.66         0.99         35.34         0.9968         0.9953         0.85           27.55         32.45         18.74         21.26         46.39         1.21         40         0.9968         0.9953         0.85           27.57         32.45         18.74         21.26         48.47         51.53         0.94         36.601         0.9993         0.9734         0.85           29.79         32.40         18.68         48.47         51.53         0.94         36.601         0.			0.10	13.02	19.04	46.88	53.12	0.88	32.06	0.9972	0.9404	0.85	0.56	0.70	0.97	0.67	0.62	89.0	0.65	0.65
29,77         31,97         38,264         1,0000         0,9794         0.88           26,76         36,15         15,49         20,02         49,78         50,22         0,99         38,264         1,0000         0,9794         0.84           36,94         31,53         14,87         16,67         53,60         46,40         1,16         31,532         0,9962         0,977         0.84           36,94         31,53         14,87         16,67         53,60         46,40         1,16         31,532         0,9982         0,977         0.95           26,51         38,15         16,67         19,84         47,34         52,66         35,014         0,9982         0,997         0,83           27,55         32,45         12,16         22,22         44,67         45,33         1,21         43,386         0,999         0,993         0,993           28,49         37,10         17,16         22,22         44,67         45,33         1,21         43,386         0,999         0,991         0,991           29,79         36,60         32,07         48,37         51,53         0,94         36,41         0,993         0,91         38,74           21,30<			2.91	16.66	21.55	50.43	49.57	1.02	38.212	0.9999	0.9765	78.0	0.65	0.75	0.91	0.61	09.0	0.57	0.53	0.64
26.76         36.15         15.49         21.60         48.36         51.64         0.94         37.089         0.9992         0.9670         0.84           36.44         31.53         14.87         16.07         53.60         46.01         11.6         31.532         0.9962         0.9970         0.95           28.43         36.56         16.11         18.91         47.34         52.66         0.90         35.014         0.9958         0.9972         0.85           27.55         32.45         18.74         21.06         48.31         1.21         40         0.9938         0.9937         0.89           27.57         32.45         18.04         41.12         55.88         0.79         36.60         0.89         0.82           27.72         36.61         0.99         36.71         0.9993         0.9842         0.91           27.77         36.67         36.47         0.97         36.61         0.9993         0.9734         0.88           27.77         36.67         36.77         0.97         36.61         0.9993         0.9734         0.88           27.77         36.57         36.57         36.57         0.9993         0.9734         0.88			1.97	18.25	20.02	49.78	50.22	0.99	38.264	1.0000	0.9794	0.88	69.0	0.72	06.0	0.57	0.58	0.52	0.56	0.59
36.94         31.53         14.87         16.67         53.60         46.40         1.16         31.532         0.9962         0.9477         0.55           26.51         36.56         19.68         46.19         15.36         46.09         35.342         0.9962         0.9477         0.95           26.51         38.15         15.66         19.68         46.19         53.82         0.86         35.342         0.9968         0.9538         0.83           27.55         32.45         21.16         21.25         48.81         51.20         0.996         0.9936         0.9835         0.85           25.49         37.91         17.97         18.63         44.12         55.88         0.79         36.601         0.9909         0.9918         0.991           29.76         32.57         17.20         21.15         0.94         36.715         0.9993         0.9734         0.88           27.27         36.50         17.33         48.47         51.53         6.07         0.97         36.60         0.9999         0.9722         0.88           27.27         20.43         49.77         50.67         0.97         36.201         0.9999         0.9722         0.88 <th></th> <th></th> <th>3.15</th> <th>15.49</th> <th>21.60</th> <th>48.36</th> <th>51.64</th> <th>0.94</th> <th>37.089</th> <th>0.9992</th> <th>0.9670</th> <th>0.84</th> <th>0.62</th> <th>0.75</th> <th>0.94</th> <th>0.61</th> <th>0.62</th> <th>0.61</th> <th>0.59</th> <th>0.68</th>			3.15	15.49	21.60	48.36	51.64	0.94	37.089	0.9992	0.9670	0.84	0.62	0.75	0.94	0.61	0.62	0.61	0.59	0.68
28.43         36.56         16.11         18.91         47.34         52.66         0.90         35.014         0.9988         0.9926         0.86           26.51         38.15         15.66         19.68         46.19         53.82         0.86         35.342         0.9988         0.9926         0.83           27.55         24.16         11.6         22.22         48.81         51.20         0.96         40         0.9988         0.933         0.83           25.49         37.41         17.97         18.64         44.7         51.53         0.94         40.9908         0.9649         0.82           29.79         37.49         18.04         18.68         48.47         51.53         0.94         36.61         0.9903         0.9734         0.88           29.79         37.49         18.64         18.68         48.47         51.53         0.94         36.71         0.993         0.9734         0.88           21.20         22.27         48.27         1.07         36.379         0.9993         0.9734         0.88           21.27         36.24         49.33         50.67         1.07         36.379         0.9993         0.9734         0.88			1.53	14.87	16.67	53.60	46.40	1.16	31.532	0.9962	0.9477	0.95	0.61	0.65	06.0	0.61	89.0	0.63	0.57	0.67
26,51         38.15         15.66         19.68         46.19         53.82         0.86         35.342         0.9958         0.9958         0.8938         0.83           27,55         32.45         18.74         21.26         48.81         51.20         0.95         40         0.9958         0.9937         0.85           25,49         37.91         17.97         18.63         44.12         55.88         0.79         36.01         0.9900         0.9849         0.85           29.06         37.91         18.63         44.12         55.88         0.79         36.01         0.9900         0.9949         0.82           29.06         32.57         17.20         21.16         50.23         49.77         1.01         38.364         1.0000         0.9731         0.87           27.27         36.36         14.31         22.07         49.33         50.67         0.97         36.39         0.99         0.99         0.90         0.9734         0.85           25.39         39.47         16.59         49.70         50.05         0.78         35.141         0.9984         0.9569         0.88           29.70         36.60         49.70         50.09         35.10 </th <th></th> <th></th> <th>3.56</th> <th>16.11</th> <th>18.91</th> <th>47.34</th> <th>52.66</th> <th>06.0</th> <th>35.014</th> <th>0.866.0</th> <th>0.9626</th> <th>98.0</th> <th>0.64</th> <th>0.70</th> <th>0.95</th> <th>0.55</th> <th>0.58</th> <th>0.55</th> <th>0.62</th> <th>0.58</th>			3.56	16.11	18.91	47.34	52.66	06.0	35.014	0.866.0	0.9626	98.0	0.64	0.70	0.95	0.55	0.58	0.55	0.62	0.58
27.55         32.45         18.74         21.26         48.81         51.20         0.95         40         0.9996         0.9835         0.85           32.45         24.16         21.16         22.22         54.67         45.38         0.79         36.601         0.9996         0.9835         0.85           25.49         37.91         17.97         18.63         44.12         55.88         0.79         36.601         0.9996         0.9937         0.91           25.49         37.91         17.97         18.64         48.47         51.53         0.94         36.715         0.9993         0.9774         0.88           29.06         32.57         17.20         21.16         50.23         49.77         0.97         36.379         0.9999         0.9781         0.88           27.27         36.37         10.37         36.379         0.9999         0.9782         0.85           31.30         32.50         16.41         19.13         48.27         1.07         36.201         0.9999         0.9622         0.88           25.39         39.46         14.70         50.90         46.10         1.17         46.399         0.9999         0.9659         0.88			3.15	15.66	19.68	46.19	53.82	98.0	35.342	0.9958	0.9593	0.83	0.63	0.72	96.0	0.55	09.0	0.69	0.52	0.65
32.45         21.16         22.22         54.67         45.33         1.21         43.386         0.9937         0.9882         0.91           25.49         37.91         17.97         18.63         44.7         51.53         0.94         36.601         0.9907         0.99437         0.9982         0.91           29.79         37.40         18.64         18.65         48.47         51.53         0.94         36.715         0.9903         0.9734         0.88           29.06         32.57         14.20         21.16         50.23         49.77         1.01         38.364         1.0000         0.9734         0.88           27.27         36.56         14.31         22.74         49.37         50.43         0.9993         0.9734         0.88           28.39         39.47         16.59         18.67         48.27         1.07         36.201         0.9994         0.9659         0.80           28.70         36.61         19.13         47.83         52.17         0.92         35.54         0.9986         0.9659         0.88           29.84         22.36         14.5         53.90         46.10         1.17         46.399         0.9956         0.9954			2.45	18.74	21.26	48.81	51.20	0.95	40	0.9996	0.9835	0.85	0.70	0.75	0.91	0.58	0.65	0.60	0.56	0.60
25.49         37.91         17.97         18.63         44.12         55.88         0.79         36.61         0.9990         0.9449         0.82           29.79         33.49         18.04         18.68         44.17         15.3         0.94         36.715         0.9900         0.9734         0.88           29.06         32.57         17.20         21.16         50.23         49.77         1.01         38.364         1.0000         0.9734         0.88           27.27         36.37         17.00         21.01         38.364         1.0000         0.9734         0.87           31.30         32.50         15.77         20.43         51.77         10.77         36.201         0.9991         0.9622         0.85           25.39         39.47         16.59         18.55         43.95         56.05         0.78         35.141         0.9894         0.9659         0.86           29.70         36.66         14.24         20.00         49.70         50.99         35.41         0.9986         0.9659         0.88           29.84         22.35         24.05         53.90         46.10         1.17         46.39         0.9956         0.9956         0.9954			1.16	21.16	22.22	54.67	45.33	1.21	43.386	0.9937	0.9892	0.91	0.74	0.76	08.0	0.53	09.0	0.57	0.58	0.59
29,79         33,49         18,64         18,68         48,47         51,53         0.94         36,715         0.9993         0.9774         0.88           29,70         32,57         17,20         21,16         50,23         49,77         1,01         38,364         1,0000         0.9781         0.87           27,27         36,36         14,31         22,07         49,33         50,67         1,07         36,379         0,999         0,972         0.87           21,30         32,50         16,77         20,43         50,67         0,97         36,379         0,999         0,902         0.82           28,70         32,50         16,41         19,13         47,85         56,14         0,9884         0,9669         0,80           28,70         36,67         0,97         35,14         0,9884         0,9669         0,88           28,70         36,67         0,99         34,542         1,0000         0,986         0,986         0,86           29,84         22,35         24,05         53,90         46,10         1,17         46,399         0,995         0,995         0,995         0,995			7.91	17.97	18.63	44.12	55.88	0.79	36.601	0.9900	0.9649	0.82	89.0	69.0	96.0	0.63	0.63	0.53	0.59	0.61
29.06         32.57         17.20         21.16         50.23         49.77         1.01         38.364         1.0000         0.9781         0.87           27.27         36.36         14.31         22.07         49.33         50.67         1.07         36.379         0.9999         0.9622         0.85           31.30         32.50         15.77         20.43         51.73         48.77         1.07         36.201         0.9999         0.9662         0.85           25.39         39.47         16.59         18.55         43.95         56.05         0.78         35.41         0.9894         0.9662         0.82           28.70         35.76         16.41         19.13         47.83         52.17         0.99         35.541         0.9986         0.9662         0.86           29.40         48.70         50.90         46.10         1.17         46.39         0.9956         0.9954         0.88           29.84         23.76         53.90         46.10         1.17         46.39         0.9956         0.9956         0.9956         0.9956         0.986			3.49	18.04	18.68	48.47	51.53	0.94	36.715	0.9993	0.9734	0.88	89.0	69.0	0.92	0.62	0.59	0.57	0.56	09.0
27.27         36.36         14.31         22.07         49.33         50.67         0.97         36.379         0.9999         0.9622         0.85           25.39         32.40         15.77         20.43         51.73         48.27         1.07         36.201         0.9999         0.9622         0.85           25.39         32.47         16.59         18.55         43.95         56.05         0.78         35.141         0.9894         0.9662         0.82           28.70         35.76         16.41         19.13         47.83         52.17         0.92         34.242         1.0000         9.86         0.9659         0.86           29.84         23.76         22.35         24.05         53.90         46.10         1.17         46.39         0.9578         0.88           29.84         22.76         26.05         46.10         1.17         46.39         0.9566         0.9578         0.88			2.57	17.20	21.16	50.23	49.77	1.01	38.364	1.0000	0.9781	0.87	99.0	0.74	0.91	0.57	09.0	0.62	0.59	0.63
31.30         32.50         15.77         20.43         51.73         48.27         1.07         36.201         0.9991         0.9699         0.90           25.39         39.47         16.59         18.55         43.95         56.05         0.78         35.141         0.9894         0.9562         0.82           28.70         35.76         16.41         19.13         47.83         50.37         0.99         34.242         1.0986         0.9659         0.86           29.70         36.06         14.24         20.00         49.70         50.30         0.99         34.242         1.0000         0.9578         0.88           29.84         23.76         22.35         24.05         53.90         46.10         1.17         46.399         0.9956         0.9954         0.88           29.84         23.76         22.35         24.05         53.90         46.10         1.17         46.399         0.9956         0.9954         0.88			3.36	14.31	22.07	49.33	50.67	0.97	36.379	0.9999	0.9622	0.85	0.59	92.0	0.95	0.62	09.0	0.62	0.58	0.65
25.39 39.47 16.59 18.55 43.95 56.05 0.78 35.141 0.8984 0.9562 0.82 28.70 35.06 16.41 19.13 47.83 52.17 0.99 34.242 1.0000 0.9578 0.86 29.84 23.76 22.35 24.05 48.10 1.17 46.399 0.9956 0.9559 0.88 29.84 23.76 22.35 24.05 48.10 1.17 46.399 0.9956 0.99578 0.88			2.50	15.77	20.43	51.73	48.27	1.07	36.201	0.9991	0.9699	06.0	0.63	0.73	0.91	0.59	0.57	0.61	0.55	0.61
28.70 35.76 16.41 19.13 47.83 52.17 0.92 35.541 0.9986 0.9659 0.86 29.70 35.06 14.24 20.00 49.70 50.30 0.99 34.242 1.0000 0.9578 0.88 29.84 23.76 22.35 24.05 53.90 46.10 1.17 46.399 0.9056 0.9056 0.9054 0.88 20.80 20			3.47	16.59	18.55	43.95	56.05	0.78	35.141	0.9894	0.9562	0.82	0.65	69.0	0.97	0.57	0.63	0.56	0.60	0.56
29.70 36.06 14.24 20.00 49.70 50.30 0.99 34.242 1.0000 0.9578 0.88 29.84 23.76 22.35 24.05 53.90 46.10 1.17 46.399 0.9956 0.9954 0.88			5.76	16.41	19.13	47.83	52.17	0.92	35.541	0.9986	0.9659	98.0	0.64	0.70	0.94	0.58	0.55	0.56	0.56	0.59
29.84 28.37 22.35 24.05 53.90 46.10 1.17 46.399 0.9956 0.988			3.06	14.24	20.00	49.70	50.30	0.99	34.242	1.0000	0.9578	0.88	0.59	0.72	0.94	0.58	0.56	0.55	09.0	0.57
10 0 0000 0 0000 00 10 0 10 10 10 10 10			3.76	22.35	24.05	53.90	46.10	1.17	46.399	0.9956	0.9954	88.0	0.77	08.0	0.79	0.59	0.63	0.63	0.52	0.56
Z1.09 55:09 15:10 Z1.41 49:15 50:050 0:91 50:050 0:9996 0:905			5.69	15.16	21.47	49.15	50.85	0.97	36.626	0.9998	0.9663	0.85	0.61	0.75	0.94	0.61	0.61	29.0	0.63	99.0

A vivid spatial organizations based comparisons are made for a sample of ten genomes and their associated genes which reveal their inter and intra linked relationships among the SARS-CoV2 and other CoVs of the same genus. In near future, we wish to explore the whole set of genome data of SARS-CoV2, MERS and SARS-like other coronavirus in different strains such as Bat, pangolin and etc.

#### 340 Authors Contributions and Conflicts of Interest:

The author SH has formulated and carried out the study with RKR. The authors SH and RKR analyse the data results and written the manuscript and finally both the authors checked and approved the manuscript. The authors declare that there is no conflicts of interest.

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