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Genetic Code as Binary BCD and Gray Code

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ABSTRACT

In modern communication technology, secured transfer of any kind of data is a persistent problem. The genetic code provides information encoded within genetic material. Genetic code so much in common use that encryption of information regarding this requires new methods. In this paper we provide new genetic codes for the basic 20 amino acids using decimals, binary numbers, gray codes taking the basic, acidic, polar, non-polar properties of the amino acids. This enables encryption of details regarding genetic codes.

Keywords: DNA, RNA, Amino Acids, Genetic coding, Gray code, Binary Code, Nucleotides, Acidic, Basic, Polar, Non-Polar.

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INTRODUCTION

DNA

Deoxyribonucleic acid (DNA) is a molecule that encodes the genetic instructions used in the development and functioning of all known living organisms and many viruses. Along with RNA and proteins, DNA is one of the three major macromolecules essential for all known forms of life. Genetic information is encoded as a sequence of nucleotides (guanine, adenine, thymine, and cytosine) recorded using the letters G, A, T, and C. Most DNA molecules are double-stranded helices, consisting of two long polymers of simple units called nucleotides, molecules with backbones made of alternating sugars (deoxyribose) and phosphate groups (related to phosphoric acid), with the nucleobases (G, A, T, C) attached to the sugars. DNA is well-suited for biological information storage, since the DNA backbone is resistant to cleavage and the double-stranded structure provides the molecule with a built-in duplicate of the encoded information [1].

RNA

Ribonucleic acid (RNA) is a ubiquitous family of large biological molecules that perform multiple vital roles in the coding, decoding, regulation, and expression of genes. Together with DNA, RNA comprises the nucleic acids, which, along with proteins, constitute the three major macromolecules essential for all known forms of life. Like DNA, RNA is assembled as a chain of nucleotides, but is usually single-stranded. Cellular organisms use messenger RNA (mRNA) to convey genetic information (often notated using the letters G, A, U, and C for the nucleotides guanine(G), adenine(A), uracil(U) and cytosine(C)) that directs synthesis of specific proteins, while many viruses encode their genetic information using an RNA genome. Some RNA molecules play an active role within cells by catalyzing biological reactions, controlling gene expression, or sensing and communicating responses to cellular signals. One of direct the assembly of proteins on ribosomes. This process uses transfer RNA (tRNA) molecules to deliver amino acids to the ribosome, where ribosomal RNA (rRNA) links amino acids together to form proteins [2].

DNA to RNA

Transcription is the first step of gene expression, in which a particular segment of DNA is copied into RNA by the enzyme RNA polymerase. Both RNA and DNA are nucleic acids, which use base pairs of nucleotides as a complementary language that can be converted back and forth from DNA to RNA by the action of the correct enzymes. During transcription, a DNA sequence is read by an RNA polymerase, which produces a complementary, antiparallel RNA strand. As opposed to DNA replication, transcription results in an RNA complement that includes uracil (U) in all instances where thymine (T) would have occurred in a DNA complement. Also unlike DNA replication where DNA is synthesized, transcription does not involve an RNA primer to initiate RNA synthesis [3].

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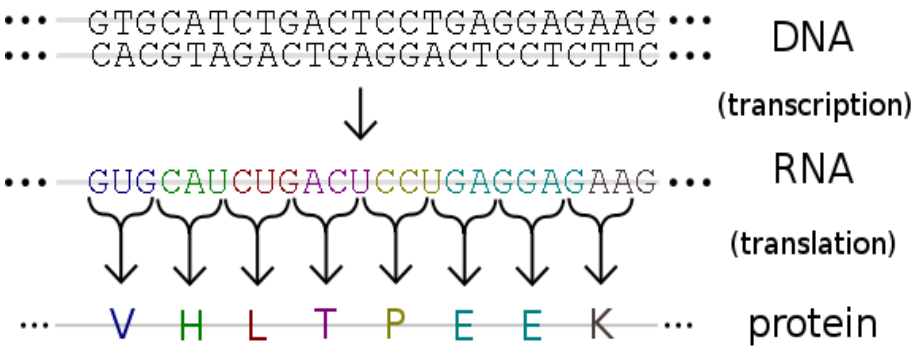
DNA to RNA to Protein



Genetic Code

The genetic code is the set of rules by which information encoded within genetic material (DNA or mRNA sequences) is translated into proteins (amino acid sequences) by living cells. Biological decoding is accomplished by the ribosome, which links amino acids in an order specified by mRNA, using transfer RNA (tRNA) molecules to carry amino acids and to read the mRNA three nucleotides at a time. The genetic code is highly similar among all organisms, and can be expressed in a simple table with 64 entries. The code defines how sequences of these nucleotide triplets, called codons, specify which amino acid will be added next during protein synthesis. With some exceptions, a three-nucleotide codon in a nucleic acid sequence specifies a single amino acid. Because the vast majority of genes are encoded with exactly the same code (see the RNA codon table), this particular code is often referred to as the canonical or standard genetic code, or simply the genetic code, though in fact some variant codes have evolved. For example, protein synthesis in human mitochondria relies on a genetic code that differs from the standard genetic code [4].

MATERIALS AND METHODS

In this paper we provide three types of genetic codes using decimals, binary conversion, gray codes for the 20 amino acids.

Proposed Genetic Code

Consider the following snapshot [5]

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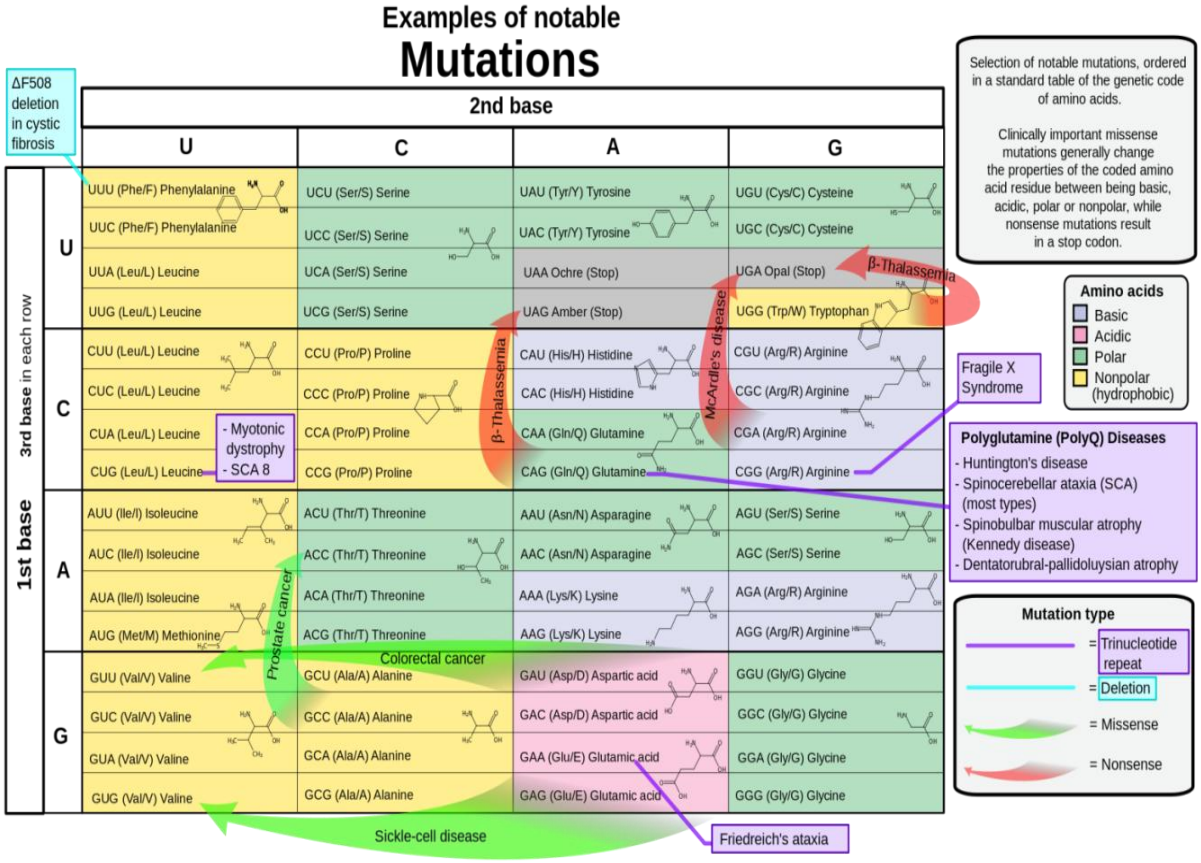

This provides details of the basic, acidic polar and non-polar properties of the amino acids. With this as the base table we provide new genetic codes for these 20 amino acids.

We know that the four types of nucleotides are ATGC in case of DNA and AUGC in RNA.

Basic Code

The basic code is of 7 character length, which is constructed as follows.

Step 1 The first two characters represent RNA or DNA using the conversion in table 1.
Step 2 Characters 3, 4, 5 represents nucleotides using table 2.
Step 3 The last two characters represents the basic, acidic, polar or nonploar property using table 3.

This can be summarized as

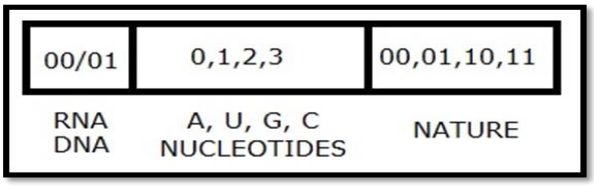

Table 1

	Representation
RNA	00
DNA	01

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Table 2

Nucleotide	Decimal Representation
A	0
U / T	1
G	2
C	3

Table 3

Property	Binary Representation
Basic	00
Acidic	01
Polar	10
Nonpolar	11

Example

- Valine

  This is an RNA with nucleotide combination GUU,GUC,GUA and non polar.
  So the conversion for the combination GUU is 00.211.11.

- Serine

This is an DNA with nucleotide combination TCT,TCC,TCA,TCG and polar.
So the conversion for the combination UCU 01.131.01.
The complete basic code table for RNA and DNA is provided in table 4 and table 5.

DECIMAL TO BCD

Step 1 This conversion follows the basic rule of 4-bit codes. Let the 4-bits be ABCD
that is A B C D
0 0 0 0

Here the value of each bit is in the power of 2's, that is
D = 2^0=1
C = 2^1=2
B = 2^2=4

A = 2^3=8

If the bit is 1 then the value is added and if its 0 then not

Example 5 = 0101 = 0x8 + 1x4 + 0x2 + 1x1 = 4 + 1 = 5.

Step 2 We generate a code of length 20 from the Basic table. We know that the first two characters of the basic code is 00 if it represents RNA and 01 if it is a DNA. We now replace this by 0000 or 0001, that is the first four characters is 0000 if the code is for an RNA or 0001 if the code is for DNA.

Step 3 The next 12 characters is obtained from the nucleotide part of the basic table using step 1.

Step 4 The last four characters are obtained from the basic, acidic, polar, nonpolar property from the basic code. The last two characters in the basic code is 00, 01, 10, 11 which is replaced by 0000, 0001, 0010, 0011 respectively in the BCA code.

Example

- Valine

  This is an RNA with nucleotide combination GUU,GUC,GUA and non polar.
  So the basic code for the combination GUU is 00.211.11. The BCD code is 0000. 001100010001. 0011

- Serine

  This is an DNA with nucleotide combination TCT,TCC,TCA,TCG and polar.
  So the basic code for the combination UCU 01.131.01. The corresponding BCD code is 01.000100100001.0001.

The complete BCD conversion table is given in table 6 and table 7.

BCD TO GRAY CODE

Step 1 In this conversion the BCD code is converted to the Gray code. We consider the 4-bit BCD code as ABCD
Let the gray code 4-bits be considered as WXYZ
To convert BCA to gray code we take the first bit A and keep it as it is, that is W = A.
Then X = W + B. The sum is X and the carry is taken over
Now, Y = X + C + carry of X
Y is the sum and the carry is taken over
Z = Y + D + carry of Y

Example: Let the BCD code be 1100, that is ABCD = 1100. Let us convert this into gray code WXYZ.

W = A = 1
X = W + B = 1 + 1 = 0, carry of X = 1
Y = X + C + carry of X = 0 + 0 + 1 = 1, carry of Y = 0
Z = Y + D + carry of Y = 1 + 0 + 0 = 0.
Therefore, WXYZ = 1010

Step 2 We generate a code of length 20 from the BCA code. The first and last four characters are retained as it is in the BCA code.

Step 3 The middle 12 characters is obtained from the nucleotide part of the BCA code using step 1.

Example

- Valine

  This is an RNA with nucleotide combination GUU,GUC,GUA and non polar.
  The BCA code is 0000. 001100010001. 0011. Hence the Gray code is 0000. 001000010001.0010

- Serine

  This is an DNA with nucleotide combination TCT,TCC,TCA,TCG and polar.
  So the basic code for the combination UCU 01.131.01. The corresponding BCA code is 0001.000100100001.0001. The gray code is 0001. 0001001100001.0001.

The decimal to binary and gray code conversion is given in table 8. The complete BCA to gray code conversion table is given in table 9 and table 10

IILUSTRATION

Suppose we want to encrypt the message as Serine Glycine, then this could be encoded as one of the following

For BCD 0001.000100100001.0001 followed by 0001.001000100010.0011

For GRAY code 0001.000100110001.0001 followed by 0001.001100110011.0010

Communicating details about the DNA sequence of humans also is becoming necessary these days due to various reasons. It becomes mandatory in criminology and other domains. This procedure provides a method of encrypting details of any DNA sequence. For example if the following sequence represents the DNA of a human,

ATCGAATTCGCGCTGAGTCACAATTCGCGCTGAGTCACAATTCGCGCTGAGTCACAATTGTGACTCA GCCGCGAATTCCTGCAGCCCCGAATTCCGCATTGCAGAGATAATTGTATTTAA. Dividing this into segments of length k = 3 we get

ATC GAA TTC GCG CTG AGT CAC AAT TCG CGC TGA GTC ACA ATT CGC GCT GAG TCA CAA TTG TGA CTC AGC CGC GAA TTC CTG CAG CCC CGA ATT CCG CAT TGC AGA GAT AAT TGT ATT TAA.

This now can be converted into a DECIMAL using table 2 as 013 200 113 232 312 021 303 001 132 323 120 213 030 011 323 231 202 130 300 112 120 313 023 323 200 113 312 302 333 320 011 332 301 123 020 201 001 121 011 100
(For DNA 01 is prefixed)

This can be converted into a binary string using table 7 as

000000010011	001000000000	000100010011	001000110010	001100010010
000000100001	001100000011	000000000001	000100110010	001100100011
000100100000	001000010011	000000110000	000000010001	001100100011
001000110001	001000000010	000100110000	001100000000	000100010010
000100100000	001100010011	000000100011	001100100011	001000000000
000100010011	001100010010	001100000010	001100110011	001100100000
000000010001	001100110010	001100000001	000100100011	000000100000

001000000001 000000000001 000100100001 000000010001 000100000000

The given DNA can be converted as a RNA strand also. Converting as RNA strand we obtain AUC GAA UUC GCG CUG AGU CAC AAU UCG CGC UGA GUC ACA AUU CGC GCU GAG UCA CAA UUG UGA CUC AGC CGC GAA UUC CUG CAG CCC CGA AUU CCG CAU UGC AGA GAU AAU UGU AUU UAA.

This can be converted into a DECIMAL using table 2 as 013 200 113 232 312 021 303 001 132 323 120 213 030 011 323 231 202 130 300 112 120 313 023 323 200 113 312 302 333 320 011 332 301 123 020 201 001 121 011 100 (For RNA 00 is prefixed)

This can be converted into a binary string using table 6 as

000000010011	001000000000	000100010011	001000110010	001100010010
000000100001	001100000011	000000000001	000100110010	001100100011
000100100000	001000010011	000000110000	000000010001	001100100011
001000110001	001000000010	000100110000	001100000000	000100010010
000100100000	001100010011	000000100011	001100100011	001000000000
000100010011	001100010010	001100000010	001100110011	001100100000
000000010001	001100110010	001100000001	000100100011	000000100000

001000000001 000000000001 000100100001 000000010001 000100000000.

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Table 4 RNA Basic Code Table

	U		C		A		G		
U	UUU	00.111.11	UCU	00.131.10	UAU	00.101.10	UGU	00.121.10	U
	UUC	00.113.11	UCC	00.133.10	UAC	00.103.10	UGC	00.123.10	C
	UUA	00.110.11	UCA	00.130.10	UAA	00.100.00	UGA	00.120	A
	UUG	00.112.11	UCG	00.132.10	UAG	00.102.00	UGG	00.122.11	G
C	CUU	00.311.11	CCU	00.331.11	CAU	00.301.00	CGU	00.321.00	U
	CUC	00.313.11	CCC	00.333.11	CAC	00.303.00	CGC	00.323.00	C
	CUA	00.310.11	CCA	00.330.11	CAA	00.300.01	CGA	00.320.00	A
	CUG	00.312.11	CCG	00.332.11	CAG	00.302.01	CGG	00.322.00	G
A	AUU	00.011.11	ACU	00.031.10	AAU	00.001.01	AGU	00.021.10	U
	AUC	00.013.11	ACC	00.033.10	AAC	00.003.01	AGC	00.023.10	C
	AUA	00.010.11	ACA	00.030.10	AAA	00.000.00	AGA	00.020.00	A
	AUG	00.012.11	ACG	00.032.10	AAG	00.002.00	AGG	00.022.00	G
G	GUU	00.211.11	GCU	00.231.11	GAU	00.201.01	GGU	00.221.11	U
	GUC	00.213.11	GCC	00.233.11	GAC	00.203.01	GGC	00.223.11	C
	GUA	00.210.11	GCA	00.230.11	GAA	00.200.01	GGA	00.220.11	A
	GUG	00.212.11	GCG	00.232.11	GAG	00.202.01	GGG	00.222.11	G

Table 5: DNA Basic Code Table

	T		C		A		G		
T	TTT	01.111.11	TCT	01.131.10	TAT	01.101.10	TGT	01.121.10	T
	TTC	01.113.11	TCC	01.133.10	TAC	01.103.10	TGC	01.123.10	C
	TTA	01.110.11	TCA	01.130.10	TAA	01.100.00	TGA	01.120	A
	TTG	01.112.11	TCG	01.132.10	TAG	01.102.00	TGG	01.122.11	G
C	CTT	01.311.11	CCT	01.331.11	CAT	01.301.00	CGT	01.321.00	T
	CTC	01.313.11	CCC	01.333.11	CAC	01.303.00	CGC	01.323.00	C
	CTA	01.310.11	CCA	01.330.11	CAA	01.300.01	CGA	01.320.00	A
	CTG	01.312.11	CCG	01.332.11	CAG	01.302.01	CGG	01.322.00	G
A	ATT	01.011.11	ACT	01.031.10	AAT	01.001.01	AGT	01.021.10	T
	ATC	01.013.11	ACC	01.033.10	AAC	01.003.01	AGC	01.023.10	C
	ATA	00.010.11	ACA	01.030.10	AAA	01.000.00	AGA	01.020.00	A
	ATG	01.012.11	ACG	01.032.10	AAG	01.002.00	AGG	01.022.00	G
G	GTT	01.211.11	GCT	01.231.11	GAT	01.201.01	GGT	01.221.11	T
	GTC	01.213.11	GCC	01.233.11	GAC	01.203.01	GGC	01.223.11	C
	GTA	01.210.11	GCA	01.230.11	GAA	01.200.01	GGA	01.220.11	A
	GTG	01.212.11	GCG	01.232.11	GAG	01.202.01	GGG	01.222.11	G

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Table 6:RNA BCD Code Table

	U		C		A		G		
U	UUU	0000.000100 010001.0011	UCU	0000.000100 110001.0010	UAU	0000.000100 000001.0010	UGU	0000.000100 100001.0010	U
	UUC	0000.000100 010011.0011	UCC	0000.000100 110011.0010	UAC	0000.000100 000011.0010	UGC	0000.000100 100011.0010	C
	UUA	0000.000100 010000.0011	UCA	0000.000100 110000.0010	UAA	0000.000100 000000.0000	UGA	0000.000100 10000.	A
	UUG	0000.000100 010010.0011	UCG	0000.000100 110010.0010	UAG	0000.000100 000010.0000	UGG	0000.000100 100010.0011	G
C	CUU	0000.001100 010001.0011	CCU	0000.001100 110001.0011	CAU	0000.001100 000001.0000	CGU	0000.001100 100001.0000	U
	CUC	0000.001100 010011.0011	CCC	0000.001100 110011.0011	CAC	0000.001100 00011.0000	CGC	0000.001100 100011.0000	C
	CUA	0000.001100 010000.0011	CCA	0000.001100 110000.0011	CAA	0000.001100 000000.0001	CGA	0000.001100 100000.0000	A
	CUG	0000.001100 010010.0011	CCG	0000.001100 110010.0011	CAG	0000.001100 000010.0001	CGG	0000.001100 100010.0000	G
A	AUU	0000.000000 010001.0011	ACU	0000.000000 110001.0010	AAU	0000.000000 000001.0001	AGU	0000.000000 100001.0010	U
	AUC	0000.000000 010011.0011	ACC	0000.000000 110011.0010	AAC	0000.000000 000011.0001	AGC	0000.000000 100011.0010	C
	AUA	0000.000000 010000.0011	ACA	0000.000000 110000.0010	AAA	0000.000000 000000.0000	AGA	0000.000000 100000.0000	A
	AUG	0000.000000 010010.0011	ACG	0000.000000 110010.0010	AAG	0000.000000 000010.0000	AGG	0000.000000 100010.0000	G
G	GUU	0000.001000 010001.0011	GCU	0000.001000 110001.0011	GAU	0000.001000 000001.0001	GGU	0000.001000 100001.0011	U
	GUC	0000.001000 010011.0011	GCC	0000.001000 110011.0011	GAC	0000.001000 000011.0001	GGC	0000.001000 100011.0011	C
	GUA	0000.001000 010000.0011	GCA	0000.001000 110000.0011	GAA	0000.001000 000000.0001	GGA	0000.001000 100000.0011	A
	GUG	0000.001000 010010.0011	GCG	0000.001000 110010.0011	GAG	0000.001000 000010.0001	GGG	0000.001000 100010.0011	G

Table 7: DNA BCD Code Table

	T		C		A		G		
T	TTT	0001.00010001 0001.0011	TCT	0001.00010 0110001.00 10	TAT	0001.00010 0000001.00 10	TGT	0001.0001001 00001.0010	T
	TTC	0001.00010001 0011.0011	TCC	0001.00010 0110011.00 10	TAC	0001.00010 0000011.00 10	TGC	0001.0001001 00011.0010	C
	TTA	0001.00010001 0000.0011	TCA	0001.00010 0110000.00 10	TAA	0001.00010 0000000.00 00	TGA	0001.0001001 0000.	A
	TTG	0001.00010001 0010.0011	TCG	0001.00010 0110010.00 10	TAG	0001.00010 0000010.00 00	TGG	0001.0001001 00010.0011	G
C	CTT	0001.00110001 0001.0011	CCT	0001.00110 0110001.00 11	CAT	0001.00110 0000001.00 00	CGT	0001.0011001 00001.0000	T

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	CTC	0001.00110001 0011.0011	CCC	0001.00110 0110011.00 11	CAC	0001.00110 000011.000 0	CGC	0001.0011001 00011.0000	C
	CTA	0001.00110001 0000.0011	CCA	0001.00110 0110000.00 11	CAA	0001.00110 0000000.00 01	CGA	0001.0011001 00000.0000	A
	CTG	0001.00110001 0010.0011	CCG	0001.00110 0110010.00 11	CAG	0001.00110 0000010.00 01	CGG	0001.0011001 00010.0000	G
A	ATT	0001.00000001 0001.0011	ACT	0001.00000 0110001.00 10	AAT	0001.00000 0000001.00 01	AGT	0001.0000001 00001.0010	T
	ATC	0001.00000001 0011.0011	ACC	0001.00000 0110011.00 10	AAC	0001.00000 0000011.00 01	AGC	0001.0000001 00011.0010	C
	ATA	0001.00000001 0000.0011	ACA	0001.00000 0110000.00 10	AAA	0001.00000 0000000.00 00	AGA	0001.0000001 00000.0000	A
	ATG	0001.00000001 0010.0011	ACG	0001.00000 0110010.00 10	AAG	0001.00000 0000010.00 00	AGG	0001.0000001 00010.0000	G
G	GTT	0001.00100001 0001.0011	GCT	0001.00100 0110001.00 11	GAT	0001.00100 0000001.00 01	GGT	0001.0010001 00001.0011	T
	GTC	0001.00100001 0011.0011	GCC	0001.00100 0110011.00 11	GAC	0001.00100 0000011.00 01	GGC	0001.0010001 00011.0011	C
	GTA	0001.00100001 0000.0011	GCA	0001.00100 0110000.00 11	GAA	0001.00100 0000000.00 01	GGA	0001.0010001 00000.0011	A
	GTG	0001.00100001 0010.0011	GCG	0001.00100 0110010.00 11	GAG	0001.00100 0000010.00 01	GGG	0001.0010001 00010.0011	G

Table 8: Gray code, Binary Conversion

DECIMAL	GRAY	BINARY
0	0000	0000
1	0001	0001
2	0011	0010
3	0010	0011
4	0110	0100
5	0111	0101
6	0101	0110
7	0100	0111
8	1100	1000
9	1101	1001
10	1111	1010
11	1110	1011
12	1010	1100
13	1011	1101
14	1001	1110
15	1000	1111

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Table 9: RNA Gray Code Table

	U		C		A		G		
C	CUU	0000.001000010001.0010	CCU	0000.001000100001.0010	CAU	0000.00100001.0000	CGU	0000.001000110001.0000	U
	CUC	0000.001000010010.0010	CCC	0000.001000100010.0010	CAC	0000.000000010.0000	CGC	0000.001000110010.0000	C
	CUA	0000.00100001000000.0010	CCA	0000.001000100000.0010	CAA	0000.000000000.0010	CGA	0000.001000110000.0000	A
	CUG	0000.001000010011.0010	CCG	0000.001000100011.0010	CAG	0000.000000011.0010	CGG	0000.001000110011.0000	G
A	AUU	0000.000000010001.0010	ACU	0000.000000100001.0011	AAU	0000.0001.00000001	AGU	0000.000000110001.0011	U
	AUC	0000.000000010010.0010	ACC	0000.000000100010.0011	AAC	0000.00000010.0010	AGC	0000.000000110010.0011	C
	AUA	0000.000000010000.0010	ACA	0000.000000100000.0010	AAA	0000.00000.0000	AGA	0000.000000110000.0000	A
	AUG	0000.000000010011.0010	ACG	0000.000000100011.0010	AAG	0000.00011.0000	AGG	0000.000000110011.0000	G
G	GUU	0000.001100010001.0010	GCU	0000.001100100001.0010	GAU	0000.00110000001.0001	GGU	0000.001100110001.0010	U
	GUC	0000.001100010010.0010	GCC	0000.001100100010.0010	GAC	0000.00110000001.0001	GGC	0000.001100110010.0010	C
	GUA	0000.001100010000.0010	GCA	0000.001100100000.0010	GAA	0000.00110000000.00000001	GGA	0000.001100110000.0010	A
	GUG	0000.001100010011.0010	GCG	0000.001100100011.0010	GAG	0000.00110000001.0001	GGG	0000.001100110011.0010	G

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Table 10: DNA Gray Code Table

	T		C		A		G		
T	TTT	0001.00010100010001.0010	TCT	0001.000100100001.0011	TAT	0001.00110001.0011	TGT	0001.000100110001.0011	T
T	TTC	0001.00010010.0010	TCC	0001.000100100010.0011	TAC	0001.00110010.0011	TGC	0001.000100110010.0011	C
	TTA	0001.000100010011.0010	TCA	0001.000100100000.0011	TAA	0001.00110000.0000	TGA	0001.000100110000.0000	A
	TTG	0001.000100110011.0010	TCG	0001.000100100011.0011	TAG	0001.00110011.0000	TGG	0001.000100110011.0010	G
C	CTT	0001.001000010001.0010	CCT	0001.001000100001.0010	CAT	0001.00100001.0000	CGT	0001.001000110001.0000	T
	CTC	0001.001000010010.0010	CCC	0001.001000100010.0010	CAC	0001.001000000010.0000	CGC	0001.001000110010.0000	C
	CTA	0001.001000000010000.0010	CCA	0001.001000100000.0010	CAA	0001.001000000000.00000001	CGA	0001.001000110000.0000	A
	CTG	0001.001000010011.0010	CCG	0001.001000100011.0010	CAG	0001.001000000011.00000001	CGG	0001.001000110011.0000	G
A	ATT	0001.000000010001.0010	ACT	0001.000000100001.0011	AAT	0001.0001.00000001	AGT	0001.000000110001.0011	T
	ATC	0001.000000010010.0010	ACC	0001.000000100010.0011	AAC	0001.00000010.00000001	AGC	0001.000000110010.0011	C
	ATA	00000000.000000010000.0010	ACA	0001.000000100000.0011	AAA	0001.000000000000.0000	AGA	0001.000000110000.0000	A
	ATG	0001.000000010011.0010	ACG	0001.000000100011.0011	AAG	0001.00000011.0000	AGG	0001.000000110011.0000	G

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G	GTT	0001.00110001 0001.0010	GCT	0001.00110010 0001.0010	GAT	0001.00110 001.0001	GGT	0001.001100 110001.0010	T
	GTC	0001.00110001 0010.0010	GCC	0001.00110010 0010.0010	GAC	0001.00110 0000010.00 01	GGC	0001.001100 110010.0010	C
	GTA	0001.00110001 0000.0010	GCA	0001.00110010 0000.0010	GAA	0001.00110 0000000.00 01	GGA	0001.001100 110000.0010	A
	GTG	0001.00110001 0011.0010	GCG	0001.00110010 0011.0010	GAG	0001.00110 0000011.00 01	GGG	0001.001100 110011.0010	G

CONCLUSION

In encryption DNA and binary strands are used because they can be of any length and hence can be used in encrypting messages of any length. The proposed method provides a new genetic code for the existing 20 amino acids as binary strings and hence can be used for sending any information involving amino acids, DNA, RNA as a binary string. There is no difference between a real binary sequence and a faked one that is encrypted by us. A large number of binary sequence a publicly available in various website. So a string carrying information about DNA or RNA cannot be differentiated. So the proposed genetic code is a good choice for encrypting information in public domain.

REFRENCES

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