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RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (4 Year) Degree in Information and Communication Technology
Fourth Year - Semester I Examination – October/November 2017

ICT 4207 – Bioinformatics and Computational Biology

Time: Two (02) hours

Answer **ALL** Questions.
Total 100 Marks.

1. a) Briefly explain what Bioinformatics is. (04 Marks)
b) What is the complementary DNA sequence of the following string of nucleotides?
Label the 5' and 3' ends of the sequence. (05 Marks)
$$5' - A - G - G - T - C - T - A - A - C - G - 3'$$

c) DNA consists of a double strand of nucleotide. Clearly discuss the statement.
d) Illustrate the "Central Dogma" of molecular biology. (06 Marks)
e) Explain the protein structuring process. (05 Marks)
f) Explain functionality of the protein synthesis. (05 Marks)
2. a) What is the biological motivation behind "Sequence Alignment" (04 Marks)
b) Using Pair -Wise alignment find the best alignment. (06 Marks)

$$s(x, y) = \begin{cases} +5 & \text{if } x = y \\ -3 & \text{if } x \neq y \end{cases}$$

$g = -4$ linear gap penalty

Alignments:

1. TCAGG - C - A
TCTAGGCTA
2. TCA - GGC - A
TCTAGGCTA

- c) Compare and contrast Global Alignment and Local Alignment. (05 Marks)
- d) Consider the following two DNA sequences

GCTCAGA
ATCTCAGA

Scoring parameters: match = +1, mismatch = -1, gap penalty = -2.

By clearly mentioning steps find optimal **Global Alignment** of these sequences.

(10 Marks)

3. a) What does it mean by "Phylogenetic tree"? (02 Marks)
- b) Using a diagram display the components of phylogenetic trees. (03 Marks)
- c) Trees can be constructed from various types of data.
- List the data types for building trees. (02 Marks)
 - Given 4 taxa, what are the possible unrooted trees? Draw them. (05 Marks)
 - What are the general phylogenetic tree approaches? (03 Marks)
- d) Construct a phylogenetic tree to explain the genetic relationship among A, B, C, D & E using UPGMA method. (08 Marks)

	A	B	C	D	E
A	0	22	39	39	41
B		0	41	41	43
C			0	18	20
D				0	10
E					0

- Compute the quality of above phylogenetic tree. (02 Marks)
4. Write short notes on below topics
- Introns and exons
 - Human genome
 - Mutations
 - BLAST
- (25 Marks)