JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE & TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

UNIVERSITY SPECIAL EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES

4th YEAR FIRST SEMESTER 2019/2020 ACADEMIC YEAR

MAIN CAMPUS - REGULAR

COURSE CODE: SBI 3431

COURSE TITLE: Bioinformatics and Computational Biology

EXAM VENUE: STREAM:

DATE: EXAM SESSION:

TIME: 2 HOURS

Instructions:

1. Answer ALL questions in Section A and Any two questions in Section B
2. Candidates are advised not to write on question paper
3. Candidates must hand in their answer booklets to the invigilator while in the examination room

SECTION A: SHORT ANSWER QUESTIONS (30 MARKS)

1. Describe three different kinds of DNA sequences (3 Marks)
2. Briefly distinguish the terms homologs, orthologs and paralogs. (3 Marks)
3. Outline three advantages of evolutionary computation (3 Marks)
4. Describe three hierarchical levels of protein structure (3Marks)
5. Explain what is meant by gene ontology. Identify two organizing principles of gene ontology (3 Marks)
6. Define sequence alignment. Describe the difference between local and global alignment (3 Marks)
7. Consider the (pairwise) global alignments below resulting from the application of the algorithm Needleman-Wunsch to the sequences S1, S2 and S3 using the following scoring scheme: match=+2; mismatch=-1 and gap=-1. (3 Marks)

   S1: C G _ _ A A   S1: C G _ A A   S2: G G T T A A

   S2: G G T T A A   S3: T G T A A   S3: T G T _ A A

8. Distinguish among protein domain, motif and family. (3 Marks)
9. Identify three databases available through Entrez (3 Marks)
10. Based on the data in the table shown below, **draw** a phylogenetic tree that reflects the evolutionary relationships of the organisms based on the differences in their cytochrome *c* amino-acid sequences and **explain** the relationships of the organisms. Based on the data, **identify** which organism is most closely related to the chicken and **explain** your choice. (3 Marks)

THE NUMBER OF AMINO ACID DIFFERENCES IN CYTOCHROME *c* AMONG VARIOUS ORGANISMS

	Horse	Donkey	Chicken	Penguin	Snake
Horse	0	1	11	13	21
Donkey		0	10	12	20
Chicken			0	3	18
Penguin				0	17
Snake					0

SECTION B: ESSAY QUESTIONS (40 MARKS).

11. Discuss the basic principle of shotgun genome sequencing, assembly and annotation. (20 Marks)
12. Describe the dot matrix analysis plot method of pairwise sequence alignment. (20Marks)
13. Discuss the use of computational biology and bioinformatics in functional genomics and proteomics. (20 Marks)
14. Describe the features and importance of NCBI (National Center for Biotechnology Information). (20 Marks)