

UNIVERSITY OF SWAZILAND
RESIT EXAMINATION PAPER: JULY 2018

TITLE OF PAPER: GENOMICS

COURSE CODE: BIO 342

TIME ALLOWED: THREE HOURS

- INSTRUCTIONS:
1. ANSWER SECTION A (COMPULSORY) AND ANY TWO OTHER QUESTIONS IN SECTION B.
 2. QUESTION 1 CARRIES FIFTY (50) AND MARKS AND EACH QUESTION IN SECTION B CARRIES TWENTY FIVE (25) MARKS
 3. ANSWER A TOTAL OF 3 (THREE) QUESTIONS
 4. ILLUSTRATE YOUR ANSWERS WITH LARGE AND CLEARLY LABELLED DIAGRAMS WHERE APPROPRIATE

SPECIAL REQUIREMENTS: NONE

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[PLEASE TURN OVER]

Section A: Answer ALL questions in this section**Question 1 A [MULTIPLE CHOICE QUESTIONS] (8 marks)**

1) Nucleotides used to terminate DNA synthesis during Sanger sequencing differ from normal nucleotides in which position of the deoxyribose sugar?

- A) 1'
- B) 2'
- C) 3'
- D) 5'

2) The nucleotides referred to in Question 1A.1 are called _____.

- A) ribonucleotides
- B) deoxynucleotides
- C) dideoxynucleotides
- D) anticodons

3) Why do the nucleotides referred to in Question 1A.1 and 1A.2 cause DNA replication to stop?

- A) they bind to DNA polymerase making it fall off the DNA template
- B) they are lacking a 5' phosphate
- C) they are lacking a 3' hydroxyl group
- D) they contain ribose instead of deoxyribose

4) Which of the following is required a Sanger sequencing reaction?

- A) all four dNTPS
- B) one dideoxynucleotide
- C) primer
- D) all of the above

5) In Sanger sequencing, which enzyme is used?

- A) DNA polymerase
- B) reverse transcriptase
- C) RNA-dependent DNA polymerase
- D) Primase

6) After gel electrophoresis, following Sanger sequencing, the band at the bottom of the gel represents _____.

- A) the first 5' base
- B) the first 3' base
- C) the largest DNA fragment
- D) the slowest DNA fragment

7) What is the matrix that is used in gel electrophoresis of Sanger sequencing products?

- A) starch
- B) agarose
- C) polyacrylamide
- D) cellulose

8) What is the function of the template DNA during DNA sequencing?

- A) it provides a 3'-OH group for the DNA polymerase
- B) it provides the DNA sequence that you are trying to determine
- C) it is used for the incorporation of the dideoxynucleotides
- D) no DNA template is needed

Question 1 B [SHORT-ANSWER QUESTIONS]

B.1 Draw an arbitrary phylogenetic tree and label the following:

- (i) Root,
- (ii) Basal taxon,
- (iii) Node,
- (iv) Branch,
- (v) Clade,
- (vi) Sister taxa,
- (vii) Polytomy. (7 marks)

B.2 Briefly discuss the following:

- (i) Shotgun whole genome assembly, (7 marks)
- (ii) Clone-by-clone whole genome sequencing, (7 marks)
- (iii) Gene knock-outs, (7 marks)
- (iv) Fluorescent in situ hybridization (FISH). (6 marks)

B.3 Suppose you have completed an RNA sequencing experiment and found evidence for anti-sense transcription of a specific gene in yeast.

- (i) Suggest an alternative method that can be used to detect the presence of anti-sense RNA. (2 marks)
- (ii) Briefly describe how the length (size) of the antisense RNA present in the yeast cells can be determined. (2 marks)
- (iii) Briefly describe how it can be determine whether or not the antisense RNA is polyadenylated. (4 marks)

[Total marks = 50]

Section B: Answer any TWO questions in this section

Question 2

(a) Explain the principle of cycle sequencing. (9 marks)

(b) Discuss the merits and demerits of Next Generation Sequencing methodologies. (16 marks)

[Total marks = 25]

Question 3

Discuss DNA microarrays and RNA sequencing, highlighting their applications in biochemical and biomedical functional genomics research. (25 marks)

[Total marks = 25]

Question 4

Evaluate application of bioinformatics structural and functional genomics. (25 marks)

[Total marks = 25]

END OF EXAMINATION PAPER