TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

BTMB

PAPER 2

ABT 4405: BIOINFORMATICS

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: Pick Date May 2016

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

Question ONE

a. Define the following terms.

i.	Biological database	1 mark
ii.	Accession number	1 mark
iii.	Biosis	1 mark

b. Give the meaning of the following terms:

i.	ASCII	½ mark
ii.	PSSM	½ mark
iii.	XML	½ mark
iv.	UPGMA	½ mark

c. Describe the BSML file format. 6 marks

d. Outline any FIVE limitations of bioinformatics. 5 marks

e. Distinguish between Parsimony and Maximum likelihood tree building algorithms. 4 marks

f. You are given the following pairs of sequences:

      1. DDBICEKDDATU
      2. DRBICEKADATM

      3. CBOCADACTUMD
      4. CKECADAGTUUD

   a. Calculate similarity scores between the pair of sequences using an identity matrix (assume mismatch=0, and match=1). 4 marks

g. Describe the following primary protein sequence database. 6 marks

   i. PDB

   ii. TrEMBL

Question TWO

Explain the following BLAST programs.

   i. Tblastx 10 marks

   ii. Blastx 10 marks

Question THREE

a. Explain the general guidelines to consider when designing primers. 8 marks

b. Describe FOUR bioinformatic tools you would use to design primers. 8 marks

c. Use the Standard Code for Information Interchange table below to solve the following.

	30	40	50	60	70	80	90	100	110	120
0		(	2	<	F	P	Z	d	n	x
1		)	3	=	G	Q	[	e	o	y
2		*	4	>	H	R	\	f	p	z
3	!	+	5	?	I	S	]	g	q	{
4	"	,	6	@	J	T	^	h	r	|
5	#	-	7	A	K	U	_	i	s	}
6	$	.	8	B	L	V		j	t	~
7	%	/	9	C	M	W	a	k	u	DEL
8	&	0	:	D	N	X	b	l	v	
9	'	1	;	E	O	Y	c	m	w	

Given a character w

    i. Calculate the corresponding Phred quality score based on fastq-solexa format.

          4 marks

Question FOUR

a. Using an illustration, explain the position specific iterative-BLAST (PSI-BLAST) approach.

          8 marks

b. Use the BLOSUM 62 and PAM250 substitution matrices below to solve the following questions

BLOSUM 62

```
    A  R  N  D  C  Q  E  G  H  I  L  K  M  F  P  S  T  W  Y  V
A   4 -1 -2 -2  0 -1 -1  0 -2 -1 -1 -1 -1 -2 -1  1  0 -3 -2  0
R  -1  5  0 -2 -3  1  0 -2  0 -3 -2  2 -1 -3 -2 -1 -1 -3 -2 -3
N  -2  0  6  1 -3  0  0  0  1 -3 -3  0 -2 -3 -2  1  0 -4 -2 -3
D  -2 -2  1  6 -3  0  2 -1 -1 -3 -4 -1 -3 -3 -1  0 -1 -4 -3 -3
C   0 -3 -3 -3  9 -3 -4 -3 -3 -1 -1 -3 -1 -2 -3 -1 -1 -2 -2 -1
Q  -1  1  0  0 -3  5  2 -2  0 -3 -2  1  0 -3 -1  0 -1 -2 -1 -2
E  -1  0  0  2 -4  2  5 -2  0 -3 -3  1 -2 -3 -1  0 -1 -3 -2 -2
G   0 -2  0 -1 -3 -2 -2  6 -2 -4 -4 -2 -3 -3 -2  0 -2 -2 -3 -3
H  -2  0  1 -1 -3  0  0 -2  8 -3 -3 -1 -2 -1 -2 -1 -2 -2  2 -3
I  -1 -3 -3 -3 -1 -3 -3 -4 -3  4  2 -3  1  0 -3 -2 -1 -3 -1  3
L  -1 -2 -3 -4 -1 -2 -3 -4 -3  2  4 -2  2  0 -3 -2 -1 -2 -1  1
K  -1  2  0 -1 -3  1  1 -2 -1 -3 -2  5 -1 -3 -1  0 -1 -3 -2 -2
M  -1 -1 -2 -3 -1  0 -2 -3 -2  1  2 -1  5  0 -2 -1 -1 -1 -1  1
F  -2 -3 -3 -3 -2 -3 -3 -3 -1  0  0 -3  0  6 -4 -2 -2  1  3 -1
P  -1 -2 -2 -1 -3 -1 -1 -2 -2 -3 -3 -1 -2 -4  7 -1 -1 -4 -3 -2
S   1 -1  1  0 -1  0  0  0 -1 -2 -2  0 -1 -2 -1  4  1 -3 -2 -2
T   0 -1  0 -1 -1 -1 -1 -2 -2 -1 -1 -1 -1 -2 -1  1  5 -2 -2  0
W  -3 -3 -4 -4 -2 -2 -3 -2 -2 -3 -2 -3 -1  1 -4 -3 -2 11  2 -3
Y  -2 -2 -2 -3 -2 -1 -2 -3  2 -1 -1 -2 -1  3 -3 -2 -2  2  7 -1
V   0 -3 -3 -3 -1 -2 -2 -3 -3  3  1 -2  1 -1 -2 -2  0 -3 -1  4
```

PAM250

```
    A  R  N  D  C  Q  E  G  H  I  L  K  M  F  P  S  T  W  Y  V
A   2 -2  0  0 -2  0  0  1 -1 -1 -2 -1 -1 -3  1  1  1 -6 -3  0
R  -2  6  0 -1 -4  1 -1 -3  2 -2 -3  3  0 -4  0  0 -1  2 -4 -2
N   0  0  2  2 -4  1  1  0  2 -2 -3  1 -2 -3  0  1  0 -4 -2 -2
D   0 -1  2  4 -5  2  3  1  1 -2 -4  0 -3 -6 -1  0  0 -7 -4 -2
C  -2 -4 -4 -5 12 -5 -5 -3 -3 -2 -6 -5 -5 -4 -3  0 -2 -8  0 -2
Q   0  1  1  2 -5  4  2 -1  3 -2 -2  1 -1 -5  0 -1 -1 -5 -4 -2
E   0 -1  1  3 -5  2  4  0  1 -2 -3  0 -2 -5 -1  0  0 -7 -4 -2
G   1 -3  0  1 -3 -1  0  5 -2 -3 -4 -2 -3 -5  0  1  0 -7 -5 -1
H  -1  2  2  1 -3  3  1 -2  6 -2 -2  0 -2 -2  0 -1 -1 -3  0 -2
I  -1 -2 -2 -2 -2 -2 -2 -3 -2  5  2 -2  2  1 -2 -1  0 -5 -1  4
L  -2 -3 -3 -4 -6 -2 -3 -4 -2  2  6 -3  4  2 -3 -3 -2 -2 -1  2
K  -1  3  1  0 -5  1  0 -2  0 -2 -3  5  0 -5 -1  0  0 -3 -4 -2
M  -1  0 -2 -3 -5 -1 -2 -3 -2  2  4  0  6  0 -2 -2 -1 -4 -2  2
F  -3 -4 -3 -6 -4 -5 -5 -5 -2  1  2 -5  0  9 -5 -3 -3  0  7 -1
P   1  0  0 -1 -3  0 -1  0  0 -2 -3 -1 -2 -5  6  1  0 -6 -5 -1
S   1  0  1  0  0 -1  0  1 -1 -1 -3  0 -2 -3  1  2  1 -2 -3 -1
T   1 -1  0  0 -2 -1  0  0 -1  0 -2  0 -1 -3  0  1  3 -5 -3  0
W  -6  2 -4 -7 -8 -5 -7 -7 -3 -5 -2 -3 -4  0 -6 -2 -5 17  0 -6
Y  -3 -4 -2 -4  0 -4 -4 -5  0 -1 -1 -4 -2  7 -5 -3 -3  0 10 -2
V   0 -2 -2 -2 -2 -2 -2 -1 -2  4  2 -2  2 -1 -1 -1  0 -6 -2  4
```

    Given the pairs of sequences below;

        1. DWSDEVKA
        2. YWSDEVKA

3. DEVKDWSA
4. DEKVDWSS

Calculate similarity scores between these sequences using:

    i. PAM250 matrix   4 marks

    ii. Identity matrix (assume match =2, and mismatch = 0)   4 marks

    iii. BLOSUM 62 matrix   4 marks

Question FIVE

a. Distinguish between ENZYME and REBASA databases.   14 marks

b. Describe three bioinfomatic tools you would use to align two sequences.   6 marks