INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF SCIENCE AND TECHNOLOGY

END OF SEMESTER EXAMINATIONS - AUGUST 2025

PROGRAMME: BSEM
YEAR/SEM: YEAR 1/SEMESTER 1
COURSE CODE: BSE1101
NAME: MATHEMATICS FOR ENVIRONMENTAL SCIENCE

DATE:
TIME:

INSTRUCTIONS TO CANDIDATES:

SECTION A

Attempt all (40 Marks, Write the correct alternative in the booklet provided)

Question 1:

1. If A and B are mutually exclusive events, the probability of the union of A or B is given by

a) P(A or B) = P(A) *P(B)

b) P(A or B) = P(A) + P(B)-P(A and B)

c) P(A or B) = P(A) + P(B)

d) P(A or B) = 0

2. If events A and B are independent, P(A) = 0.6 and P(B) = 0.5, find P(A and B).

a) P(A and B) = 0.5

b) P(A and B) = 0.6

c) P(A and B) = 0.3

d) P(A and B) = 1.1

3. Consider the following five relations on the set $A = \{1, 2, 3, 4\}$: $S1 = \{(1, 1), (1, 2), (2,2),(3,3),(4, 4)\}$, $S2 = \{(1, 1)(1, 2), (2, 1)\}$, $S3 = \{(1, 3),(3,1),(2, 1)\}$ and $S4 = A^2$. Determine which of the relations are symmetric.

a) S1 and S2

b) S1 and S3

c) S2 and S4

d) S1 and S4

4. Find the number of combinations of 5 objects, A, B, C, D, E taken 2 at a time.

a) 20 combinations

b) 7 combinations

c) 10 combinations

d) 5 combinations

5. The *domain* of a relation *R* is the set of all second elements of the ordered pairs which belong to *R*.

a) True

b) False

6. Find the cardinal number of the set: $A = \{a, b, c, \ldots, y, z\}$

a) 5

b) 26

c) 25

d) 27

7. The integer value of -3.5 is given by

a) -3.5

b) -3.

c) -4

d) -2

8. Which of the following statement is a proposition?

a) Get me a glass of milkshake

b) God bless you!

c) What is the time now?

d) The only odd prime number is 2

9. A matrix having one row and many columns is known as?

a) Column matrix

b) Identity matrix

c) Diagonal matrix

d) Row matrix.

10. Consider the following five relations on the set $A = \{1, 2, 3, 4\}$: $R1 = \{(1, 1), (1, 2), (2, 3), (1, 3), (4, 4)\}$, $R2 = \{(1, 1)(1, 2), (2, 1), (2, 2), (3, 3), (4, 4)\}$, $R3 = \{(1, 3), (2, 1)\}$ and $R4 = A \times A$, determine which of the relations are symmetric.

a) R1 and R2

b) R3 and R4

c) R1 and R4

d) R2 and R4

11. The function f is invertible if and only if

a) *f* is both one-to-one and onto.

b) *f* is one-to-one and not onto.

c) *f* is both one-to-many and onto.

d) None of the above.

12. A compound proposition that is always _____ is called a tautology.

a) True

b) False

13. The composition function of f and g is written as fog

a) False

b) True

14. The proposition Kampala is in Uganda or Mogadishu is in South Sudan is

a) False

b) True

15. A _____ is a collection of similar elements.

a) Relation

b) Set

c) Proposition

d) Function

16. The union of the sets {0,1,3,4,7} and {1,6,7,10} is the set _____

a) {1,7}

b) {0,1,3,4,6,7,10}

c) {0,1, 2,3,4,5,6,7,8,9,10}

d) {1, 6,7,10}

17. The intersection of the sets {1,2,3,4} and {5,6,7,8} is the set _____

a) { }

b) {0}

c) {1,2,3,4}

d) {5,6,7,8}

18. The set A of even positive integers less than 20 can be expressed by

a) A={2, 4,...,18}

b) A={0, 2, 4,6,8,10}

c) A={0, 2, 4,...20}

d) A={1,2,3,... 19}

19. Two sets are called disjoint if there _____ is the empty set.

a) Intersection

b) Difference

c) Union

d) Complement

20. Floor (2.567) + Ceil(-7.001) is equal to _____

a) -5

b) -4.434

c) -6

d) none of the mentioned

Question 2:

1. What will be the value of P(not E) if P(E) = 0.07?

A) 0.93

B) 0.07

C) 0

D) 1

2. Given the sample space S={1,2,3,...,10}, what is the probability of obtaining an even number?

A) 1/5

B) 1/2

C) 2/3

D) 1/10

3. If X and Y are mutually exclusive events, the probability of X or Y is given by

A) P(X or Y)= P(X)-P(Y)

B) P(X or Y)= P(X)*P(Y)

C) P(X or Y)= P(X)+P(Y)

D) P(X or Y)= 0

4. Events A and B are such that P(A)=19/30, P(B)=2/5 and P(A or B)=4/5. Find P(A and B).

A) P(A and B)= 38/150

B) P(A and B)= 7/30

C) P(A and B)=1/2

D) P(A and B)=4/5

5. If set A = {1, 2, 3} and set B = {3, 4, 5}, what is A n B?

A) {1, 2, 3, 4, 5}

B) {3}

C) {1,2}

D) {4, 5}

6. If set A = {1, 2, 3} and set B = {3, 4, 5}, what is AUB?

A) {3}

B) {1, 2,3,4,5}

C) {1, 2, 3}

D) {4, 5}

7. What is the complement of the set A = {apple, banana, orange}?

A) {apple, banana, orange}

B) Universal set

C) {grape, peach, mango}

D) { }

8. If A = {1, 2, 3} and B = {3, 4, 5}, what is A - B (A subtract B)?

A) {1, 2, 3, 4, 5}

B) {3}

C) {4,5}

D) {1,2}

9. If set A = {1, 2, 3} and set B = {2, 3, 4}, what is A n (A U B)?

A) {1, 2, 3}

B) {2, 3}

C) {1, 2, 3, 4}

D) {2, 3, 4}

10. What is the order of the matrix below?

[Figure from the original paper could not be retrieved]

style="width: 25%;" data-filename="image.png">

A) 3X2

B) 2X3

C) 2X2

D) 3X3

11. Which of the following relations on the set {1,2,3,4} is reflexive?

A) {(1,1),(2,2),(3,3)}
B) {(1,2),(2,3),(3,4)}
C) {(1,1),(1,2),(2,1),(2,2),(3,3),(4,4)}
D) {(1,2),(2,1),(3,4),(4,3)}

12. Which of the following relations on {a,b,c} is transitive?

A) {(a,a),(b,b),(c,c),(a,b),(b,c)}
B) {(a,b),(b,c),(c,a)}
C) {(a,b),(b,c),(c,b)}
D) {(a,a),(b,b),(c,c),(a,b),(b,a),(b,c),(a,c)}

13. Let

[Figure from the original paper could not be retrieved]

style="width: 50%;" data-filename="image.png">

[Figure from the original paper could not be retrieved]

style="width: 147px;" data-filename="image.png">

14. Which of the following relations on {1,2,3} is both symmetric and antisymmetric?

A) {(1,1),(2,2),(3,3),(1,2),(2,1)}
B) {(1,1),(2,2),(3,3)}
C) {(1,1),(2,2),(3,3),(1,2),(2,1),(2,3)}
D) {(1,1),(2,2),(3,3),(1,2),(2,1),(3,2)}

15. What is the negation of the statement: "It is not sunny, and it is not raining"?

A) It is sunny or it is raining

B) It is sunny or it is not raining

C) It is sunny and it is raining

D) It is not sunny or it is raining

16. Floor (1.999) + Ceil(2.988) is equal to _____

A) 1
B) 6
C) 5
D) 4

17. If f(x)=3x-2, what is $f^{-1}(x)$

[Figure from the original paper could not be retrieved]

style="width: 125px;" data-filename="image.png">

18. In how many ways can 3 books be arranged on a shelf?

A) 3

B) 6

C) 9

D) 27

19. In how many ways can a committee of 3 people be selected from a group of 7 people?

A) 7
B) 21
C) 35
D) 42

20. How many different ways can the letters in the word "ALGORITHM" be arranged?

A) 10!

B) 10!/2!

C) 10!/(2!x3!)

D) 10!/(2!x2!)

SECTION B

Attempt any four (60 Marks)

Question 1:

In a container, there are 4 blue marbles and 2 yellow marbles. One marble is randomly drawn and then replaced. Another marble is drawn. Determine the probability that:

(a) Both marbles drawn are yellow

(b) The marbles drawn are of different colors

(c) The second marble drawn is blue given that the first marble drawn was yellow.

(d) At least one of the marbles drawn is blue.

Question 2:

(a) Let $f(x) = 0.5(3x+2)$. Find a formula for the inverse function f^{-1}.

(b) Given that $h(x)=5x^2+2$ and $f(x)=(3x+2)$. Find the composition function $h \circ f$.

Question 3:

(a) Find

(a) 22 (mod 3),

(b) 2 (mod 4),

(c) -49 (mod 5),

(b) Find the absolute values of the following

(i) -20

(ii) 4.4

Question 4:

(a) In a school, there are two clubs: Sports and Music. 15 students are in both clubs, 20 are only in Sports club and 10 students are only in Music club. Find the total number of students

(a) In the Sports club,

(b) In the music club,

(c) In either Music Club or Sports Club.

(b) Using Venn diagrams shade the following regions:

[Figure from the original paper could not be retrieved]

style="width: 841px;" data-filename="image.png">

Question 5:

(a) Determine the number of possible arrangements that can be obtained from all the letters the following words:

(a) UGANDA,

(b) SUDAN,

(c) REPUBLICOFZAIRE.

(b) Find the number of permutations that can be formed by the following objects A, B, C and D

(i) taking all at a time

(ii) taking 2 at a time

Question 6:

[Figure from the original paper could not be retrieved]

style="width: 100%;" data-filename="image.png">

Question 7:

Test the validity of the following logical arguments.

(a)

[Figure from the original paper could not be retrieved]

style="width: 50%;" data-filename="image.png">

(b)

[Figure from the original paper could not be retrieved]

style="width: 50%;" data-filename="image.png">

Question 8:

Consider the sets A = {20, 30, 40, 50} and B = {25, 30, 40, 60, 70}. Find

[Figure from the original paper could not be retrieved]

style="width: 841px;" data-filename="image.png">

Question 9:

Use Cramer's rule to solve the following system:

$3x - 2y = 1$

$5y+z = 44$

$2z - 3x = 3$

Question 10:

Let $A = \{1, 2, 3\}$, $B = \{a, b, c\}$, and $C = \{x, y, z\}$. Consider the following relations R and S from A to B and from B to C, respectively.

$R = \{(1, b), (2, a), (2, c)\}$ and $S = \{(a, y), (b, x), (c, y), (c, z)\}$

(a) Find the composition relation $R \circ S$.

(b) Find the matrices M_R, M_S, and $M_{R \circ S}$ of the respective relations R, S, and $R \circ S$, and compare $M_{R \circ S}$ to the product $M_R M_S$.

Question 11:

(a) Find the number n of ways that 8 people can arrange themselves:

(*i*) In a row of chairs,

(*ii*) Around a circular table.

(a) A class contains 7 students with 4 men and 3 women.

Find the number *n* of ways to:

(b) (*i*) Select a 3-member committee from the students.

(*ii*) Select a 6-member committee with 3 men and 3 women.

Question 12:

(a) Use matrix inversion to solve the following pair of simultaneous equations

[Figure from the original paper could not be retrieved]

style="width: 25%;" data-filename="image.png">

(a) Given the matrices

[Figure from the original paper could not be retrieved]

style="width: 50%;" data-filename="image.png">

Find

(i) A+B

(ii) A-B

(iii) AB