

SPECIALITY: COMPUTER ENGINEERING  
OPTION: DBM  
EXAM PAPER: MATHEMATICS AND STATISTIC  
CODE :SWE18  
CREDIT VALUE: 04  
DURATION: 04  
NATURE OF EXAM: WRITTEN

### SECTION A MCQ

20 Marks

1. The intercept in linear regression represents:
  - a. the strength of the relationship between  $x$  and  $y$
  - b. the expected  $x$  value when  $y$  is zero
  - c. the expected  $y$  value when  $x$  is zero
  - d. a population parameter
2. Calculate the mean number of children per family for the sample from the following table.

Number of children	Number of families
0	8
1	16
2	22
3	14
4	6
5	4
6	2

- a.1.91
  - b.2.47
  - c.3.14
  - d.2.19
3. Using the table from 2, calculate the standard deviation.

- a. 1.46
  - b. 1.45
  - c. 2.10
  - d. 2.17
- 4. The mean of ten numbers is 58. If one of the numbers is 40, what is the mean of the other nine?
  - a. 18
  - b. 60
  - c. 162
  - d. 540
- 5. A study of 1000 randomly selected flights of a major airline showed that 746 of the flights arrived on time. What is the probability of a flight arriving on time?
- 6. An expected value of a random variable is equal to its:
  - a. Variance
  - b. Standard deviation
  - c. Mean
  - d. Covariance
- 7. The expectation of the product of two independent variables X and Y is equal to:
  - a.  $E(X) E(Y)$
  - b.  $E(X) \pm E(Y)$
  - c.  $E(X + Y)$
  - d. None of the above
- 8. The standard deviation of -5, -5, -5, -5, 5 is:
  - a. -5
  - b. +5
  - c. 0
  - d. -25
- 9. The mean of an examination is 69, the median is 68, the mode is 67, and the standard deviation is 3. The measures of variation for this examination is:
  - a. 67
  - b. 68

- c. 69
  - d. 3
10. An automobile manufacturer obtains data concerning the sales of six of its dealers in the last week of 1996. The results indicate the standard deviation of their sales equals 6 autos. If this is so, the variance of their sales equals:
- a.  $\sqrt{6}$
  - b. 6
  - c.
  - d. 36
11. The measure of location which is the most likely to be influenced by extreme values in the data set is the
- a. range
  - b. median
  - c. mode
  - d. mean
12. If two events are independent, then
- a. they must be mutually exclusive
  - b. the sum of their probabilities must be equal to one
  - c. their intersection must be zero
  - d. None of these alternatives is correct.
13. Two events, A and B, are mutually exclusive and each have a nonzero probability. If event A is known to occur, the probability of the occurrence of event B is
- a. one
  - b. any positive value
  - c. zero
  - d. any value between 0 to 1
14. A numerical description of the outcome of an experiment is called a
- a. descriptive statistic
  - b. probability function
  - c. variance

- d. random variable
15. In the textile industry, a manufacturer is interested in the number of blemishes or flaws occurring in each 100 feet of material. The probability distribution that has the greatest chance of applying to this situation is the
- normal distribution
  - binomial distribution
  - Poisson distribution
  - uniform distribution
16. Which of the following is not a property of a binomial experiment?
- the experiment consists of a sequence of  $n$  identical trials
  - each outcome can be referred to as a success or a failure
  - the probabilities of the two outcomes can change from one trial to the next
  - the trials are independent
17. If we have then  $f(x)$  is a:
- Probability distribution
  - Probability density function
  - Distribution function
  - Continuous random variable
18. The height of persons in a country is a random variable of the type:
- Discrete random variable
  - Continuous random variable
  - Both (a) and (b)
  - Neither (a) and (b)
19. A bowl contains 10 balls, of which 4 are red and 6 are white. Balls are randomly selected with replacement from the bowl until 4 red balls have been selected. Let  $X$  be the number of white balls drawn before the fourth red ball is selected. Calculate  $P(X = 6)$ .
- a. 0.0012    b. 0.0187    c. 0.0446    d. 0.1003
20. Let  $A$  and  $B$  be events such that  $P(A) = 0.7$  and  $P(B) = 0.9$ . Calculate the largest possible value of  $P(A \cup B) - P(A \cap B)$ .
- a. 0.20    b. 0.34    c. 0.40    d. 0.60
21. If a sequence is decreasing, then it .....
- Converges to its infimum.

- b. Diverges.
  - c. May converges to its infimum
  - d. Is bounded.
22. If a sequence is increasing, then it .....
- a. Converges to its supremum.
  - b. Diverges.
  - c. May converges to its supremum.
  - d. Is bounded.
23. If a sequence converges to  $s$ , then ..... of its sub-sequences converges to  $s$ .
- a. each
  - b. one
  - c. few
  - d. none
24. If two sub-sequences of a sequence converge to two different limits, then the sequence .....
- a. May convergent.
  - b. May divergent.
  - c. Is convergent.
  - d. Is divergent.
25. Which is not true about number zero.
- a. Even
  - b. Positive
  - c. Additive identity
  - d. Additive inverse of zero
26. Which one of them is not interval?
- a.  $(1,2)$
  - b.  $()$
  - c.  $[3.\pi]$
  - d.  $(2\pi,180)$
27. A number which is neither even nor odd is
- a. 0
  - b. 2
  - c.  $2n$  such that  $n \in \mathbb{Z}$
  - d.  $2\pi$
28. A number which is neither positive nor negative is

- a. 0
- b. 1
- c.  $\pi$
- d. None of these

29. Concept of the divisibility only exists in set of .....

- a. natural numbers
- b. integers
- c. rational numbers
- d. real numbers

30. If a real number is not rational then it is .....

- a. integer
- b. algebraic number
- c. irrational number
- d. complex numbers

31. If  $f$  is a basis of a vector space  $V$ . Then

- (a)  $f$  is a subset of  $V$
- (b)  $f$  is a subspace of  $V$
- (c)  $f$  is a unique subset of  $V$
- (d)  $f$  is a unique subspace of  $V$

32. If  $W$  and  $U$  be two subspaces of a vector space  $V$  over a field  $F$ . Then

- (a)  $W+U$  forms a subspace
- (b)  $W$  and  $U$  forms a subspace
- (c)  $W \cup U$  forms a subspace
- (d) All of the above

33. Which is a solution of this system? 
$$\begin{cases} 2x - y = 7 \\ 3x + 5y = 4 \end{cases}$$

- A. (4, 1)      B. (-2, 2)      C. (3, -1)      D. No solution

34. The product of a  $2 \times 3$  matrix and a  $3 \times 2$  matrix is

- A.  $3 \times 3$  matrix      B.  $2 \times 2$  matrix      C.  $2 \times 3$  matrix      D. Can not be done

35. The identity matrix for a  $2 \times 2$  matrix is:

A.  $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

B.  $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

C.  $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

D.  $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$

36. Which of the following could be used to find x in this system?  $\begin{cases} 3x + 8y = 13 \\ 5x - 3y = 11 \end{cases}$

A.  $\begin{array}{r|l} \begin{array}{cc} 3 & 8 \\ 5 & -3 \end{array} & \\ \hline \begin{array}{cc} 13 & 8 \\ 11 & -3 \end{array} & \end{array}$

B.  $\begin{array}{r|l} \begin{array}{cc} 13 & 8 \\ 11 & -3 \end{array} & \\ \hline \begin{array}{cc} 3 & 8 \\ 5 & -3 \end{array} & \end{array}$

C.  $\begin{array}{r|l} \begin{array}{cc} 3 & 13 \\ 5 & 11 \end{array} & \\ \hline \begin{array}{cc} 3 & 8 \\ 5 & -3 \end{array} & \end{array}$

D.  $\begin{array}{r|l} \begin{array}{cc} 3 & 8 \\ 5 & -3 \end{array} & \\ \hline \begin{array}{cc} 3 & 13 \\ 5 & 11 \end{array} & \end{array}$

37. The two vectors (-2,1) and (1,2) are...

- a) .linearly dependent of each other
- b) .forming an orthonormal basis
- c) .perpendicular to each other
- d) .pointing in the opposite direction of each other

38. The scalar product (aka dot product) of two perpendicular vectors is

- a) .0
- b) .1
- c) .2 PI
- d) .-2 PI
- e) none of the above.

39. If s is a scalar value and v, w are two vectors in  $K^3$ , then the result of  $s + (v \times w) \cdot (v \times w)$  is.

- a) .a vector in  $K^3$
- b) .a scalar
- c) .undefined
- d) .a 3 by 3 matrix.

40. If the angle between two vectors (both having a non-zero magnitude) is greater than  $90^\circ$  and smaller than  $270^\circ$ , then the scalar product (dot product) of these vectors is.

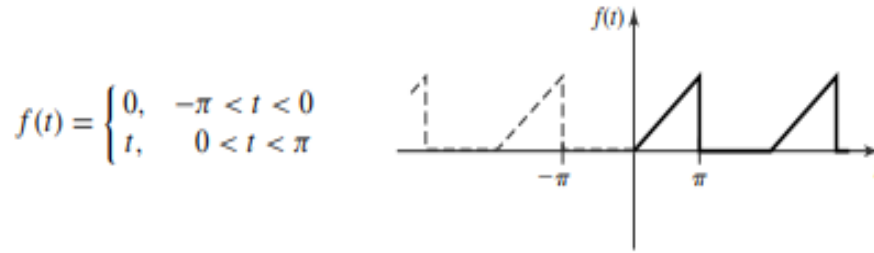
- a) .positive
- b) .negative
- c) .undefined
- d) .positive when the angle is smaller than  $180^\circ$ , negative when the angle is greater than  $180^\circ$

## SECTION B: STRUCTURALS

## 1. Analysis

25 marks

1.1. Find the Fourier series expansion for the periodic function  $f(t)$  if in one period



1.2. Calculate the Laplace transform of the function  $f(t) = t^2$ , using the definition of the Laplace transform.

1.3. Solve the initial value problem

$$6y'' - y' - y = 0, \quad y(0) = 10, \quad y'(0) = 0$$

1.4. Given the function;

$$f(r, \theta, \phi) = \begin{cases} f_1 = r \sin \theta \cos \phi \\ f_2 = r \sin \theta \sin \phi \\ f_3 = r \cos \theta \end{cases}$$

a. Find the Jacobian matrix of  $f(r, \theta, \phi)$  in the form;

$$J_f(r, \theta, \phi) = \begin{bmatrix} \frac{\partial f_1}{\partial r} & \frac{\partial f_1}{\partial \theta} & \frac{\partial f_1}{\partial \phi} \\ \frac{\partial f_2}{\partial r} & \frac{\partial f_2}{\partial \theta} & \frac{\partial f_2}{\partial \phi} \\ \frac{\partial f_3}{\partial r} & \frac{\partial f_3}{\partial \theta} & \frac{\partial f_3}{\partial \phi} \end{bmatrix}$$

b. Calculate the Jacobian determinant of  $J_f(1, \pi/2, 1)$ .

## 2. STATISTICS

25 marks

2.1. The table below represents the range of monthly wages of 50 employees in an enterprise in Douala in 2018.



Monthly wages (000FCFA)	Number of employees
50 – 100	4
100 – 150	12
150 – 200	20
200 – 250	6
250 – 300	6
300 – 350	2
Total	50

From the table above, determine the:

- Mean wage
- Modal wage
- Standard deviation
- Coefficient of variation
- Pearson's coefficient of skewness and state the nature of the distribution justifying your answer.

### 3. PROBABILITY

30 marks

3.1. At a baby shower, we started discussing baby statistics. One of the women told us she had heard a report that for every 100 babies born, there were 6 more boys than girls.

- If we were to randomly pick a child from a representative group, what is the probability of picking a girl?
- If we were to pick 10 babies at random, what is the probability that at least half of them would be girls? Hint: Use the binomial theorem:
- If we were to pick 10 babies at random, what is the probability that exactly 8 of them would be girls?
- If we were to pick 10 babies at random, what is the probability that no more than 8 of them would be boys?

3.2. A clinical test was carried out during the xmas vacation. Suppose that 1 in 1000 of the population is a carrier of the disease. Suppose also that the probability that a carrier tests negative is 1%, while the probability that a noncarrier tests positive is 5%. Let  $A$  be the event 'the patient is a carrier', and  $B$  the event 'the test result is positive'.

- A patient has just had a positive test result. What is the probability that the patient is a carrier?

- b.** A patient has just had a negative test result. What is the probability that the patient is a carrier?