M/P ENT - 04**Total No. of Pages : 12**

Day and Date : Wednesday, 18 - 09 - 2019 Time : 10.00 a.m. to 12.00 noon

Instructions : 1) All questions are compulsory.

- 2) Each question carries 2 marks.
- 3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
- Use black ball point pen only for marking the circles. Do not make **4**) any stray mark on the OMR Answer Sheet.
- Follow the instructions given on OMR Sheet. 5)
- 6) Rough work shall be done on the sheet provided at the end of question paper.
- 7) Only non-programmable calculators are allowed.
- Formulation of Research Hypothesis means: 1)
 - A) Creating a legal basis for research
 - B) Enunciation of postulates
 - Enumeration of basic principles C)
 - Formation of tentative generalization D)
- 2) Pilot study is done to
 - Identify problems B) Test the tools A)
 - C) Draw sample D) Create hypothesis
- Facts or information are analyzed and critical evaluation is made in 3)
 - A) Survey B)
 - C) Analytical research D) Pilot study

Total Marks : 100

Historical research

- **4**) 'Control Group' is a term used in
 - A) Survey research B) Historical research
 - C) Experimental research D) Descriptive research

5) Protocol means _____.

- Interchange of data between two computers A)
- B) Linkage between two computers
- C) Interchange of data between two devices
- D) Linkage between two devices
- "Construct a hypothesis" is preceded by **6**)
 - A) Conduct a literature search
 - B) Determine the design of the research.
 - C) Identify the research problem.
 - D) Select a topic

A) 4 C) 6

7) A man purchases two pens for Rs. 740. He sells one at 12% profit and the other at a 8% loss. Then he neither gains nor looses. Find the purchase price of each pen (In Rs.)

A)	324,416	B)	296,444
C)	288,452	D)	365,375

- If the first day of the ordinary year (other than the leap year) was Friday. 8) then which was the last day of that year?
 - A) Wednesday B) Thursday C) Friday D) Sunday
- 9) Fill in the missing number in the following arrangement.

8	6	4]	
3	?	7	Ī	
14	16	18		
			B)	5
			D)	8

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- 10) A man leaves for his office from his house. He walks towards East. After moving a distance of 20 meters. he turns towards to South and walks 10 meters. Then he walks 35 meters towards West and further 5 meters towards North. He then turns towards East and walk 15 meters. What is straight line distance in meters between his initial and final position?
 - A) 0 B) 5
 - C) 10 D) Can not be determined

11) Identify the correct sequence of research steps.

- A) Selection of Topics, review of literature, data collection and interpretation of findings
- B) Review of literature, Selection of Topics, data collection and interpretation of findings
- C) Selection of Topics, data collection, review of literature and interpretation of findings
- D) Selection of Topics, review of literature interpretation of findings and data collection

12) The missing number in the series 2, 7, 24, 77, ?, 723

A)	238	B)	432
C)	542	D)	320

13) Which word is different from the others?

A)	acute	B)	right
C)	obtuse	D)	parallel

14) Which of the following sequences is bounded, but not convergent? A) $(-1)^n n Sinx$ B) $(-1)^n n Cosx$

C)
$$(-1)^n Cos\left(\frac{x}{n}\right)$$
 D) $(-1)^n Sin\left(\frac{x}{n}\right)$

15) The power series $\sum_{n=0}^{\infty} \frac{(-1)^n}{(2n)!} x^{2n}$ converges for

A) $x \in (-\infty, \infty)$ B) $x \in (0, \infty)$ C) $x \in (-1, 1)$ D) No value of x

- **16**) In how many ways 4 boys and 3 girls can be seated in a row so that they are alternate.
 - A) 144 B) 288
 - C) 12 D) 256
- 17) The Jeffreys prior is proportional to the
 - A) Underlying pdf
 - B) underlying cdf
 - C) Information matrix
 - D) Square root of the information matrix
- **18)** Let X_1, X_2, \dots, X_n be an observed sample. Let $\{S_j, j = 1, 2, \dots, m\}$ be a prespecified partition of the sample space and N_j be the number of observations falling in S_j . Let P_j be the true probability of S_j under a specified distribution,

then the distribution of
$$Y = \sum_{j=1}^{m} \frac{(N_j - np_j)^2}{np_j}$$
 is _____

- A) χ^2_{m-1}
- B) χ^2_{n-1}
- C) approaches χ^2_{m-1} , as n increases
- D) approaches χ^2_{n-1} , as n increases
- **19**) The Newton-Raphson method formula for finding the square root of a real number R from the equation $x^2 R = 0$ is

A)
$$x_{i+1} = \frac{x_i}{2}$$

(C) $x_{i+1} = \frac{1}{2} \left(x_i + \frac{R}{x_i} \right)$
(D) $x_{i+1} = \frac{1}{2} \left(3x_i + \frac{R}{x_i} \right)$

- **20)** A simulation is _____ of a system.
 - A) a solution B) a validation
 - C) an imitation D) an algorithm

21) Exploratory data analysis techniques are not _____.

- A) suggestive B) indicative
- C) subjective D) objective

22) ______ estimates of precision do not require knowledge of the theoretical form of an estimator's standard error.

- A) Classical B) Bootstrap
- C) Bayesian D) None of A, B, C
- **23**) Let X ~ B(10, 0.4). Which of the following MSEXCEL function returns the value of $P(X \ge 5)$?
 - A) BINOMDIST(5, 10, 0.4, 1)
 - B) 1-BINOMDIST(4, 10, 0.4, 1)
 - C) 1-BINOMDIST(5, 10, 0.4, 1)
 - D) BINOMDIST(10, 5, 0.4, 1)

24) The COUNTA() function in MSEXCEL counts_____

- A) the number of cells that contain numbers
- B) the number of cells that are not empty in a range
- C) the number of cells that are empty in a range
- D) the number of cells that contains nonnumeric data
- 25) _____ data analysis approach allows the data to suggest admissible models that fit the data.
 - A) Exploratory B) Classical
 - C) Bayesian D) None of A, B, C
- **26)** In linear systematic sampling for 20 units from the population of 200 units, the probability that units U21 and U22 are both in a sample is
 - A) 0 B) 0.1
 - C) 0.05 D) 0.0025

- 27) Identify the odd member of the set
 - A) Measurement error
 - B) Failure to measure a unit
 - C) Editing and coding errors
 - D) Error due to selecting only a few units as sample

28)
$$\sum_{i=1}^{n} (X_i - \overline{X})^2$$
 can be expressed as
A) $X^T A X$ where $A = I_n - \frac{1}{n} E_{nn}$ B) $X^T A X$ where $A = I_n + \frac{1}{n} E_{nn}$
C) $X^T A X$ where $A = I_n$ D) None of these

- **29**) A basis for R² is _____.

 A) (1, 1), (1, 1)
 B) (1, -1), (-1, 1)

 C) (1, 0), (2, 0)
 D) (1, 1), (0, 1)
- **30)** The power of the MP test of size α for testing $H_0: \theta = 1$ against $H_1: \theta = 0$ based on a single observation from the distribution with pdf $f(x, \theta) = (2x\theta + 1 \theta), 0 < x < 1$, is

A)	\sqrt{lpha}	B)	α
C)	$\frac{\alpha}{2}$	D)	2α

- **31**) Size of the test is
 - A) Always greater than or equal to the level of significance
 - B) Always less than or equal to the level of significance
 - C) Always equal to the level of significance
 - D) Some times greater than the level of significance
- **32**) Which of the following statement (s) is (are) true?
 - I) A statistic S that is independent of every ancillary statistic is complete.
 - II) If a family of distributions is complete, its sub family is also complete.
 - A) Only I B) Only II
 - C) Both I and II D) Neither I nor II

- 33) Which of the following statement (s) is (are) true?
 - I) Chapman-Robbins-Kiefer (CRK) inequality applies even if the parameter space is discrete.
 - II) Frechet-Cramer-Rao (FCR) inequality is not applicable if the parameter space is discrete.
 - A) Only I B) Only II
 - C) Both I and II D) Neither I nor II
- **34**) Let $(X,Y) \sim$ Bivariate Normal $(0,0,\sigma_1^2,\sigma_2^2,\rho)$. Which of the following statements is wrong?
 - A) X and Y are independent only if $\rho = 0$.
 - B) X + Y and X Y are independent only if $\rho = 0$.
 - C) X + Y and X Y are independent only if $\sigma_1^2 = \sigma_2^2$.
 - D) (X + Y, X Y) is distributed as bivariate normal.
- **35**) Let X be a random variable with pdf $f(x) = \frac{2x}{\pi^2}$, $0 < x < \pi$; and 0, otherwise. What is the pdf of Y = sin(X)?
 - A) $h(y) = \frac{1}{\pi\sqrt{1-y^2}}, 0 < y < \frac{1}{2}; 0$, otherwise
 - B) $h(y) = \frac{2}{\pi(1-y^2)}, 0 < y < 1;0$, otherwise
 - C) $h(y) = \frac{2}{\pi\sqrt{1-y^2}}, 0 < y < 1; 0$, otherwise

D)
$$h(y) = \frac{1}{\pi(1+y^2)}, -\infty < y < \infty$$

- **36**) ______ should be used when factors in the population are likely to be strongly correlated.
 - B) The varimax procedure
 - C) Oblique rotation

A) Orthogonal rotation

D) None of the above

- 37) Which of the following two statement(s) is (are) true?
 - I) Hotelling's T² is invariant under non singular linear transformation
 - II) Fisher best discriminant is invariant under non singular linear transformation
 - A) Only I B) Only II
 - C) Both I and II D) Neither I nor II
- **38)** The number of linearly independent eigen vectors of $\begin{bmatrix}
 1 & 1 & 0 & 0 \\
 2 & 2 & 0 & 0 \\
 0 & 0 & 3 & 3 \\
 0 & 0 & 5 & 5
 \end{bmatrix}$ is

A)	1	B)	2
C)	3	D)	4

39) The partial derivative of the function $f(x, y, z) = e^{1-x \operatorname{Cos}(y)} + z e^{-1/(1+y^2)}$ with respect to x at the point $(1, 0, \pi)$ is

- A) 0 B) $\frac{-1}{e}$
- C) -1 D) π
- **40**) The next iterative value of the root of $x^2 4 = 0$ using the Newton-Raphson method with initial guess 3 is
 - A) 1.5 B) 2.067
 - C) 2.167 D) 3.000

41) Which of the following is correct for a sequence $\{A_n\}$ of sets?

- A) If $A_n \to A$ then $A_n^c \uparrow A^c$.
- B) If $A_n \downarrow A$ then $A_n^{c} \downarrow A^{c}$.
- C) If $A_n \uparrow A$ then $A_n^c \uparrow A^c$.
- D) If $\{A_n\}$ does not converge then $\{A_n^c\}$ does not converge to any limit

- **42**) The Basic purpose of Response Surface Methodology is
 - A) To explore the functional form of the relationship of response variable with input factors
 - B) To examine for existence of interactions across the factors influencing the response
 - C) To identify the region in the factor space where optimal response is expected
 - D) To examine whether current operating conditions of a process are optimal.
- **43**) In a general linear model $y = X\beta + \varepsilon$, _____.
 - A) any estimable linear parametric function is a linear combination of the functions $X\beta$.
 - B) if S⁻ is a g-inverse of S = X'X then S⁻ y is a least square estimator of β .
 - C) the coefficient vector of any function belonging to the error space is orthogonal to the rows of X.
 - D) a least square estimator of β is unbiased for β .
- **44**) Post optimal analysis is a technique to _____.
 - A) determine how the optimum solution of an LPP changes in response to problem inputs.
 - B) allocate resources optimally.
 - C) minimize cost operations.
 - D) spell out the relationship between dual and its primal.
- **45**) The zero-one programming problem requires that _____.
 - A) the coefficients of the decision variables are between 0 and 1.
 - B) the values of decision variables are in (0, 1).
 - C) the values of decision variables are either 0 or 1.
 - D) the coefficients of the decision variables are in (0, 1).

46) The output of the R statements: x=diag(4);mean(x[x>0]) is

- A) 1 B) 2
- C) 4 D) None of the above
- **47**) Which of the following distribution does not belong to one-parameter Cramer family of distributions?
 - A) Double exponential distribution with location θ and scale 1.
 - B) Double exponential distribution with location 1 and scale θ .
 - C) Exponential distribution with rate θ and location 1
 - D) Poisson distribution.
- **48**) Which of the following is true?
 - A) Unbiased estimator is always consistent
 - B) Consistent estimator is always unbiased
 - C) Consistent estimator is unique
 - D) Maximum likelihood estimator(MLE) need not be unbiased
- **49**) Statement 1: From a recurrent state, a transient state can not be reached. Statement 2: From a transient state, a recurrent state can be reached.
 - A) Only Statement 1 is true.
 - B) Only Statement 2 is true.
 - C) Both Statement 1 and Statement 2 are true.
 - D) Neither Statement 1 nor Statement 2 is true.

50) Let $\{X_n, n \ge 0\}$ be a Markov chain with state space $\{0, 1\}$, t.p.m. $P = \begin{bmatrix} 0.2 & 0.8 \\ 1 & 0 \end{bmatrix} \text{ and initial distribution (10/18, 8/18). Then P(X_5 = 1) is}$ A) 0
B) 0.5
C) 8/18
D) 1

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Rough Work

Rough Work