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ENTRANCE EXAMINATION – JULY 2016

QUESTION PAPER

PROGRAMME : Ph. D

MATHS

Time : 2 hours **Marks: 100**

INSTRUCTION TO THE CANDIDATES

1. Use only Pencil to indicate your answers. Use Ball-Point only for writing Name, Register Number and Signature.
2. Darken the square completely. Mark your answers like this [1] [2] [3] [4]
3. Part A is common to all.

Name of the Student: ..... Programme Applied:	Register Number Exam Centre Seal
Signature of the Student	Signature of the Invigilator

NIUEE 2016

Part A

1. The development of a solid foundation of reliable knowledge typically is built from which type of research?
   a. basic research b. action research
   c. evaluation research d. orientational research

2. The idea that when selecting between two different theories with equal explanatory value, one should select the theory that is the most simple, concise, and succinct is known as _____.
   a. criterion of falsifiability b. critical theory
   c. guide of simplicity d. rule of parsimony

3. Research that is done to examine the findings of someone else using the "same variables but different people" is which of the following?
   a. exploration b. Hypothesis c. Replication d. empiricism

4. A researcher designs an experiment to test how variables interact to influence how well children learn spelling words. In this case, the main purpose of the study was:
   a. Explanation b. Description c. Influence d. Prediction

5. What is the key defining characteristic of experimental research?
   a. extraneous variables are never present
   b. a positive correlation usually exists
   c. a negative correlation usually exists
   d. manipulation of the independent variable

6. Which of the following includes examples of quantitative variables?
   a. age, temperature, income, height
   b. grade point average, anxiety level, reading performance
   c. gender, religion, ethnic group
   d. both a and b

7. One step that is not included in planning a research study is:
   a. Identifying a researchable problem b. A review of current research
   c. Statement of the research question d. Developing a research plan

8. Sources of researchable problems can include:
   a. Researchers' own experiences as educators
   b. Practical issues that require solutions
   c. Theory and past research
   d. All of the above

9. The feasibility of a research study should be considered in light of:
   a. Cost and time required to conduct the study
   b. Skills required of the researcher
   c. Potential ethical concerns
   d. All of the above

10. A formal statement of the research question or "purpose of research study" generally _____.
    a. Is made prior to the literature review b. Is made after the literature review
    c. Will help guide the research process d. b and c

11. Which term refers to publishing several articles from the data collected in one large study?
    a. Duplicate publication b. Partial publication
    c. Triplicate publication d. None of these

12. Which of the following is a right of each participant according to the AERA?
    a. Deception b. Utilitarianism
    c. Freedom to withdraw d. Participants have no rights

13. Which of the following is a type of criterion–related validity evidence?
    a. Concurrent evidence b. Predictive evidence
    c. Internal consistency d. Both a and b are correct answers

14. Which of the following is not a type of reliability?
    a. Test-retest b. Split-half c. Content d. Internal consistency

15. Which of the following types of reliability refers to the consistency of test scores over time?
    a. Equivalent forms reliability b. Split-half reliability
    c. Test-retest reliability d. Inter-scorer reliability

16. Which type of reliability refers to the consistency of a group of individuals' scores on two equivalent forms of a test designed to measure the same characteristic?
    a. Split-half b. Test-retest c. Split-forms d. Equivalent forms

17. _____ refers to how well the particular sample of behaviors used to measure a characteristic reflects the entire domain of behaviors that constitutes that characteristic.
    a. Construct validity evidence b. Criterion-related validity evidence
    c. Content validity evidence d. Face validity evidence

18. Which of these is not a method of data collection.
    a. Questionnaires b. Interviews c. Experiments d. Observations

19. Another name for a Likert Scale is a(n):
    a. Interview protocol b. Event sampling
    c. Summated rating scale d. Ranking

20. A question during an interview such as "Why do you feel that way?" is known as a:
    a. Probe b. Filter question c. Response d. Pilot

21. A census taker often collects data through which of the following?
    a. Standardized tests b. Interviews
    c. Secondary data d. Observations

22. In which of the following nonrandom sampling techniques does the researcher ask the research participants to identify other potential research participants?
a. Snowball b. Convenience c. Purposive d. Quota

23. Which of the following is the most efficient random sampling technique?
a. Simple random sampling b. Proportional stratified sampling
c. Cluster random sampling d. Systematic sampling

24. Which of the following would usually require the smallest sample size because of its efficiency?
a. One stage cluster sampling b. Simple random sampling
c. Two stage cluster sampling d. Quota sampling

25. _____ is a set of elements taken from a larger population according to certain rules.
a. Sample b. Population c. Statistic d. Element

Part B

26. Let $f_n(x) = x^{1/n}$ for $x \in [0,1]$. Then
a. $\lim_{n\to\infty} f_n(x)$ exists for all $x \in [0,1]$ b. $\lim_{n\to\infty} f_n(x)$ defines a continuous function on [0,1]
c. $\lim_{n\to\infty} f_n(x) = 0$ for all $x \in [0,1]$ d $\{ f_n \}$ converges uniformly on [0,1]

27. Let $A = \{x^2; 0 < x<1\}$ and $B = \{x^3; 1 < x< 2\}$. Which of the following statement is true?
a. There is a one-one, onto function from A to B.
b. There is no one-one, onto function from A to B taking rational to rational
c. There is no one-one function from A to B which is onto.
d. There is no onto function from A to B which is one-one.

28. The set $\left\{\frac{1}{n}\sin\left(\frac{1}{n}\right) : n \in N\right\}$ has
a. one limit point and it is zero. b. one limit point and it is one.
c. one limit point and it is -1 d. three limit points and these are -1,0 and 1

29. Let f: C $\to$C be a complex valued function given by $f(z) == u(x,y) + i\, v(x,y)$. Suppose That $v(x,y) = 3xy^2$. Then
a. f cannot be holomorphic on C for a suitable choice of u.
b. f is holomorphic on C for a suitable choice of u.
c. f is holomorphic on C for all choice of u.
d. v is not differentiable as a function of x and y

30. The degree of the extension $Q\left(\sqrt{2}+\sqrt[3]{2}\right)$ over the field $Q\left(\sqrt{2}\right)$ is
a. 1 b.2 c. 3 d. 6

31. The dimension of the vector space of all symmetric matrices of order $n \times n$ ($n \geq 2$) with real entries and trace equal to zero is
a . $(n^2 - n)/2 - 1$ b. $(n^2 + n)/2 - 1$ c. $(n^2 - 2n)/2 - 1$ d. $(n^2 + 2n)/2 - 1$

32. Let G be a group of order 77. Then the center of G is isomorphic to
a. Z_1 b. Z_7 c. Z_{11} d. Z_{77}

33. The variational problem of extremizing the functional
$I[y(x)] = \int_0^{2\pi} \left[\left(\frac{dy}{dx} \right)^2 - y^2 \right] dx$, $y(0) = 1$, $y(2z) = 1$ has
a. a unique solution b. exactly two solutions
c. an infinite number of solutions d. no solutions

34. Consider the function $f(x) = e^{-x}$ and its Taylor approximation $g(x)$ of degree 3. For $x = 1/3$, $g(x)$ is
a. positive and less than 1 b. negative and less than -2
c. positive and greater than 1 d. less than 1 but greater than 0.75

35. Let I_1 be the ideal generated by $x^4 + 3x^2 + 2$ and I_2 be the ideal generated by $x^3 + 1$ in $Q[x]$. If $F_1 = Q[x] / I_1$ and $F_2 = Q[x] / I_2$, then
a. F_1 and F_2 are fields. b. F_1 is a field but F_2 is not a field
c. F_1 is not a field while F_2 is a field d. Neither F_1 nor F_2 is a field

36. The coefficient of correlation between x and y is 0.48.Their covariance is 36. The variance of x is 16. Find the standard deviation of y.
a.13 b. 21.5 c.18.5 d. none of these.

37. If Xand Y are jointly distributed with the correlation coefficient $r_{XY} = \frac{1}{2}$, $\sigma_X = 2$ $\sigma_Y = 3$,find Var(2X –4Y+3).
a. 123 b. 121 c. 112 d. none of these

38. Standard deviation of sampling distribution of statistic is known as
a. standard error b. sampling error c. statistic d. none of these

39. Number of independent variables which make up the statistic is known as
a. Level of significance b. degrees of freedom
c. critical region d. none of these.

40. If X and Y are independent random variables ,the Covariance of (X,Y) is _____
a.1 b. 2 c. 0 d. none of these

41. The maximum number of edges among all p vertex graphs with no triangle is
a. $\frac{p^2}{4}$ b. $\frac{p}{2}$ c. $\frac{p^2}{2}$ d. none of these

42. A graph G with at least two points is bipartite iff all its cycles are of _____ length
a. odd b. even c. either odd or even d. none of these

43. A graph is planar iff it has no sub graph homomorphic to _____
a. K_5 b. K_4 c. $K2$ d. none of these

44. If G is uniquely n – colourable, then $\delta(G) \geq$ _____
a. n b. n-1 c. n-2 d. none of these

45. If G is a graph with $p \geq 3$ vertices and $\delta \geq \frac{p}{2}$,then G is _____
a. Eulearian b. Hamiltonian c. Complete d. none of these

46. The relation between beta and gamma function is
a. $\beta(m,n) = \frac{\Gamma(m+n)}{\Gamma(m)\Gamma(n)}$ b. $\beta(m,n) = \frac{\Gamma(m)+\Gamma(n)}{\Gamma(m)\Gamma(n)}$
c. $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ d. $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m)+\Gamma(n)}$

47. The value of Γ (1/2) is
a. $\sqrt{\pi}$ b. π c. π^2 d. π^3

48. The value of $\beta(3,2)$ is
a. 1/6 b.1/4 c.1/2 d.1

49. The Legendre polynomial of $5x^3 + x$ is
a. $2P_3 + 4P_1$ b. $2P_3 - 4P_1$ c. $4P_3 + 2P_1$ d. $4P_3 - 2P_1$

50. The value of $J_{-½}(x)$ is
a. $\sqrt{\frac{2}{\pi x}}\cos x$ b. $\sqrt{\frac{\pi x}{2}}\cos x$ c. $\sqrt{\frac{2}{\pi x}}\sin x$ d. $\sqrt{\frac{\pi x}{2}}\sin x$

51. In a matrix of transition probability, the probability values should add up to one in each
a. row b. column c. diagonal d. all the above

52. In the long run, state probabilities become o and 1
a. in no case b. in some cases c. in all cases d. none of the above

53. If a matrix of transition probability is of the order nxn then the number of equilibrium equations would be
a. n b. n-1 c. n+1 d. none of the above

54. The first order Markov chain is generally used when
a. transition probabilities are fairly stable
b. change in transition probabilities is random

c. no sufficient data are available
d. all of the above

55. A discrete parameter Markov process is known as
a. Markov Chain b. Poisson process c. Gaussian process d. Evolutionary

56. Find curl grad φ if $\varphi = 3x^2yz$
a. 0 b. 1 c. 3 d. -2

57. $\nabla(AB)$ is equal to
a. $\nabla A\, \nabla B$ b. $\nabla A + \nabla B$ c. $\nabla^2 AB$ d. $B\nabla A + A\nabla B$

58. Stoke's theorem states relation between the integrals of
a. volume, surface b. volume, line
c. line, surface d. all of these

59. The vertex of $(y-3)^2 = -8(x+2)$
a. (3,-2) b. (-3,-2) c. (-3,2) d. (-2,3)

60. One focus of $x^2 + 4y^2 = 4$ is
a. (4,0) b. (2,0) c. $(\sqrt{3},0)$ d. $(\sqrt{2},0)$

61. Which of the following statement is true?
a. Every Banach space is a Hilbert space
b. Every Banach space is an inner product space
c. Every normed linear space is a Banach space
d. Every Hilbert space is a Banach space

62. Which of the following does not holds in common for both Hilbert space and Banach space?
a. complete space b. metric space
c. inner product space d. normed linear space

63. Which of the following is true?
a. very open map is continuous b. Every continuous map is open
c. Inverse of every open map is open d. Inverse of every open map is continuous

64. Which of the following is not true?
a. Every vector space is an inner product space
b. Every inner product space is a normed linear space
c. Every normed linear space is a metric space
d. Every metric space is a topological space

65. Which of the following is not a Banach space?
a. Space of all continuous complex functions on (0, 1)
b. Hilbert space
c. Space of all continuous complex functions on [3,4]
d. L^p-space

66. The solution to $\frac{dy}{dx} = -x$ with initial condition $y(0) = 1$

a. is always concave up
b. is always concave down
c. is always increasing
d. is always decreasing

67. A partial differential equation requires

a. exactly one independent variable
b. two or more independent variables
c. more than one dependent variable
d. equal number of dependent and independent variables

68. Using substitution, which of the following equations are solutions to the partial differential equation? $\frac{\partial^2 u}{\partial x^2} = 9\frac{\partial^2 u}{\partial y^2}$

a. $\cos(3x - y)$
b. $x^2 + y^2$
c. $\sin(3x - 3y)$
d. x^2+9y^2

69. The partial differential equation $5\frac{\partial^2 z}{\partial x^2} + 6\frac{\partial^2 z}{\partial y^2} = xy$ is classified as

a. elliptic
b. parabolic
c. hyperbolic
d. none of the above

70. The function y = | log x | is

a. Discontinuous at x = 1
b. Differentiable at x = 1
c. Not Differentiable at x = 1
d. None of these

71. The maximization or minimization of a quantity is the

a. goal of management science.
b. decision for decision analysis.
c. constraint of operations research.
d. objective of linear programming.

72. Decision variables

a. tell how much or how many of something to produce, invest, purchase, hire, etc.
b. represent the values of the constraints.
c. measure the objective function.
d. must exist for each constraint.

73. Which of the following is a valid objective function for a linear programming problem?

a. Max 5xy
b. Min 4x + 3y + (2/3)z
c. Max $5x^2 + 6y^2$
d. Min $(x_1 + x_2)/x_3$

74. A constraint that does not affect the feasible region is a

a. non-negativity constraint.
b. redundant constraint.
c. standard constraint.
d. slack constraint.

75. The improvement in the value of the objective function per unit increase in a right-hand side is the

a. sensitivity value.
b. shadow price.
c. constraint coefficient.
d. slack value.

76. The Laplace transform of a periodic function with period p is

a. $\frac{1}{1-e^{-sp}}\int_0^p e^{-st} f(t)dt$ b. $\frac{1}{1+e^{-sp}}\int_0^p e^{-st} f(t)dt$

c. $\frac{1}{1-e^{-sp}}\int_0^\infty e^{-st} f(t)dt$ d. $\frac{1}{1+e^{-sp}}\int_0^\infty e^{-st} f(t)dt$

77. $L^{-1}\left[\log\left(\frac{1+s}{s}\right)\right]$ =

a. $1-e^{-t}$ b. $1+e^{-t}$ c. $e^{-t}-1$ d. $e^{t}-1$

78. Consider R^2 with usual topology. The complement of N×N is
a. Open but not closed
b. Connected but not open
c. Both open and connected
d. Neither open nor connected

79. Suppose X={a, b c}. Let $\boldsymbol{T}_1$={ϕ, X, {a}, {a,b}} and $\boldsymbol{T}_1$={ϕ, X, {a}, {b, c}} Then
a. both $\boldsymbol{T}_1 \cup \boldsymbol{T}_2$ and $\boldsymbol{T}_1 \cap \boldsymbol{T}_2$ are topologies
b. neither $\boldsymbol{T}_1 \cup \boldsymbol{T}_2$ nor $\boldsymbol{T}_1 \cap \boldsymbol{T}_2$ is a topology
c. $\boldsymbol{T}_1 \cup \boldsymbol{T}_2$ is a topology but $\boldsymbol{T}_1 \cap \boldsymbol{T}_2$ is not a topology
d. $\boldsymbol{T}_1 \cap \boldsymbol{T}_2$ is a topology but $\boldsymbol{T}_1 \cup \boldsymbol{T}_2$ is not a topology

80. Let X and Y be topological spaces and f: X→Y be a continuous and bijective map. Then f is a homeomorphism if
a. X and Y are compact
b. X is a Hausdorf and Y is compact
c. X is compact and Y is Hausdorff
d. X and Y are Hausdorff

81. Let (X, d. be a metric space. Consider the metric ρ on X defined by ρ(x, y)=min{1/2, d(x, y)}, x, y∈X. Suppose $\boldsymbol{T}_1$ and $\boldsymbol{T}_2$ are topologies defined by d and ρ respectively. Then
a. $\boldsymbol{T}_1$ is a proper subset of $\boldsymbol{T}_2$
b. $\boldsymbol{T}_2$ is a proper subset of $\boldsymbol{T}_1$
c. Neither $\boldsymbol{T}_1 \subseteq \boldsymbol{T}_2$ nor $\boldsymbol{T}_2 \subseteq \boldsymbol{T}_1$
d. $\boldsymbol{T}_1 \subseteq \boldsymbol{T}_2$

82. Let PID, ED, UFD denote the set of all principal ideal domains, Euclidean domains, Unique factorization domains respectively. Then
a. UFD ⊆ ED ⊆ PID
b. PID ⊆ ED ⊆ UFD
c. ED ⊆PID ⊆ UFD
d. PID ⊆ UFD ⊆ ED

83. Let E be a connected subset of R with at least two elements. Then the number of elements in E is
a. Exactly two
b. Countably infinite
c. more than two but finite
d. uncountable

84. Consider R and S^1 with usual topology where S^1 is the unit circle in R^2. Then
a. there is no continuous map from S^1 to R
b. any continuous map from S^1 to R is the zero map
c. any continuous map from S^1 to R is a constant map
d. there are nonconstant continuous maps from S^1 to R.

85. Under the usual topology on R^3, the map f : $R^3 \rightarrow R^3$ defined by f(x,y,z)=(x+1, y-1, z) is
    a. Neither open nor closed
    b. Both open and closed
    c. open but not closed
    d. closed but not open

86. Let X be an uncountable set and let $\boldsymbol{T}$ ={U⊆ X : U is empty of U^c is finite}. Then the topological space(X, $\boldsymbol{T}$)
    a. is separable
    b. is Hausdorff
    c. has a countable basis
    d. has a countable basis at each point

87. Consider R^2 with usual topology. The complement of N×N is
    a. Open but not closed
    b. Connected but not open
    c. Both open and connected
    d. Neither open nor connected

88. Let X and Y be topological spaces and f: X→Y be a continuous and bijective map. Then f is a homeomorphism if
    a. X and Y are compact
    b. X is a Hausdorf and Y is compact
    c. X is compact and Y is Hausdorff
    d. X and Y are Hausdorff

89. Every Cauchy sequence is -----
    a. Unbounded sequence
    b. Divergent sequence
    c. bounded sequence
    d. None of these

90. If f : [a, b] → R is continuous and monotone function, then ----------
    a. f is Riemann integrable on [a, b]
    b. f is not Riemann integrable on [a, b]
    c. f is Riemann integrable on R
    d. $f(x) \leq f(x_0)$

91. If f : [a, b] → R is continuous on [a, b] and f is differentiable on (a, b.. If fa = fb = 0, there is c∈(a, b. : $f^1c = 0$ -------
    a. Rolle's Theorem
    b. Mean Value Theorem
    c. Intermediate Value Theorem
    d. None of these

92. The series $1 + \frac{x}{1!} + \frac{x^2}{2!} + \cdots$
    a. Convergent
    b. Divergent
    c. Oscillatory
    d. None of these

93. The topology on the real line R generated by left –open right-closed intervals (a,b] is
    a. strictly coarser than the usual topology
    b. strictly finer than the usual topology
    c. non comparable with the usual topology
    d. same as the usual topology

94. Let G be a finite group of order 200. Then the number of subgroups of G of order 25 is
    a. 1 b. 4 c. 5 d. 10

95. Let P be a matrix of order m×n and Q be a matrix of order n×p, n≠p. If rank(P)=n and rank(Q)=p, then rank(PQ) is

a. n b. p c. np d. n+p

96. Let A be any subset of any metric space. Then which of the following implies the other three

a. A is complete b. A is closed c. A is compact d. A is bounded

97. The solution of $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x$ is

a. $e^x(Ax+B) + \frac{5}{6}x^3e^x$ b. $e^x(Ax+B) - \frac{5}{6}x^3e^x$

c. $e^x(Ax+B) + \frac{1}{6}x^3e^x$ d. $e^x(Ax+B) - \frac{1}{6}x^3e^x$

98. The number of groups of order n (upto isomorphism) is

a. Finite for all values of n b. Finite for only finitely many values of n

b. Finite for infinitely many values of n c. Infinite for some values of n

99. The order of the element (2, 2) in Z4×Z6 is

a. 2 b. 6 c. 4 d. 12

100. The maximum number of edges in a simple graph with n vertices is

a. nC_2 b. nC_3 c. n d. n+1