Ph.D (Computer Science) / ET /RAT/ March **2022**

MAULANA AZAD NATIONAL URDU UNIVERSITY

Ph.D Computer Science (Research Admission Test) RAT - 2022

QUESTION PAPER BOOKLET

Time: 2 hours Max. Marks: 100

Hall Ticket No.

OMR Serial No.

INSTRUCTIONS TO THE CANDIDATES

1. Candidate should write their Hall Ticket number and OMR number on the space provided above. Candidate should not write their Hall Ticket number and OMR at any other place.
2. This booklet contains 16 pages. Candidate should check the booklet before taking the test. In case of misprint or irregularity in question numbers / pages, etc., should report to the Invigilator immediately.
3. There are 100 Multiple Choice Questions in the booklet. For each question there are four options. The candidate is required to choose the correct answer and darken the circle with blue / black ballpoint pen in the OMR sheet against the corresponding answer number.
4. Candidate will get one mark each for each correct reply in the OMR sheet. If the candidate does not bubble the correct answer against the corresponding question number in the OMR sheet, he will not get marks.
5. If the candidate bubbles more than one circle in OMR Sheet for any question, marks shall not be awarded for the question.
6. There are no Negative marks.
7. At the end of Entrance Test, candidates are allowed to take their question booklet.

Part A
Research methodology

1. According to David Bunton, A well-written conclusion should not –
   (A) Present the last word on the issues you raised in your paper.
   (B) Summarize the Research.
   (C) Ignore the importance of the Researcher's ideas.
   (D) Introduce the new ways or expanded ways of thinking on the issue.

2. Which of the sets of activities best indicate the cyclic nature of action research strategy?
   (A) Reflect, Observe, Plan, Act
   (B) Observe, Act, Reflect, Plan
   (C) Act, Plan, Observe, Reflect
   (D) Plan, Act, Observe, Reflect

3. In which of the following activities, potential for nurturing creative and critical thinking is relatively greater?
   (A) Preparing research summary
   (B) Presenting a seminar paper
   (C) Participation in research conference
   (D) Participation in a workshop

4. Which of the following are the characteristics of a seminar?
   (i) It is a form of academic instruction.
   (ii) It involves questioning, discussion and debates.
   (iii) It involves large groups of individuals.
   (iv) It needs involvement of skilled persons.
   Select the correct answer from the codes given below
   (A) (ii) and (iii)
   (B) (i), (ii) and(iv)
   (C) (ii) and (iv)
   (D) (ii), (iii) and (iv)

5. What is a Research Design?
   (A) A framework for every stage of the collection and analysis of data.
   (B) A way of conducting research that is not grounded in theory.
   (C) The choice between using qualitative or quantitative methods.
   (D) The style in which you present your research findings e.g. a graph.

6. The research area of immediate application is
   (A) Conceptual research
   (B) Action research
   (C) Fundamental research
   (D) Empirical research

7. The variable which impacts the relationship between an independent variable and a dependent variable is known as
   (A) antecedent variable
   (B) precedent variable
   (C) control variable
   (D) predictor variable

8. Which of the following sampling methods is not based on probability?
   (A) Quota Sampling
   (B) Simple Random Sampling
   (C) Stratified Sampling
   (D) Cluster Sampling

9. Which one of the following is an indication of the quality of a research journal?
   (A) h-index (B) Impact factor
   (C) g-index (D) i10-index

10. Suppose you want to investigate the working efficiency of nationalized bank in India, which one of the following would you follow?
   (A) Area Sampling (B) Multi-stage Sampling
   (C) Sequential Sampling (D) Quota Sampling

11. Research is not considered ethical if it
   (A) tries to prove a particular point.
   (B) does not investigate the data scientifically.
   (C) is not of a very high standard
   (D) does not ensure privacy and anonymity of the respondent

12. What does 'sampling cases' mean?
   (A) Sampling using a sampling frame
   (B) Identifying people who are suitable for research
   (C) Sampling people, newspapers, television programmes etc
   (D) Literally, the researcher's brief-case

13. Which one of the following is not a source of data?
   (A) Administrative records (B) Population census
   (C) GIS (D) Sample survey

14. When a research problem is related to heterogeneous population, the most suitable sampling method is:
   (A) Cluster Sampling (B) Convenient Sampling
   (C) Stratified Sampling (D) Lottery Method

15. The per capital income of India from 1950 to 1990 is four times. This study is
   (A) Social (B) Factorial
   (C) Horizontal (D) Longitudinal

16. A researcher selects a probability sample of 100 out of the total population. It is
   (A) A random sample (B) A cluster sample
   (C) A systematic sample (D) A stratified sample

17. Which of the following is the first step in a research process?
   (A) Selecting a topic (B) Formulating research problem
   (C) Development of a hypothesis (D) None of the above

18. A researcher uses statistical techniques in his problem to confirm
   (A) Whether the data could be quantified
   (B) Whether worthwhile inferences could be drawn
   (C) Whether appropriate statistical techniques are available
   (D) Whether analysis of data would be possible

19. Generalized conclusion on the basis of a sample is technically known as
(A) Statistical inference of external validity of the research
(B) Parameter inference
(C) Data analysis and interpretation
(D) All of the above

20. If a study is "reliable", this means that:
(A) It was conducted by a reputable researcher who can be trusted
(B) The measures devised for concepts are stable on different occasions
(C) The findings can be generalized to other social settings
(D) The methods are stated clearly enough for the research to be replicated

21. The importance of measurement in quantitative research is that:
(A) It allows us to delineate fine differences between people or cases
(B) It provides a consistent device or yardstick
(C) It allows for precise estimates of the degree of relationship between concepts
(D) All of the above

22. In which of the following, there is greater flexibility in both the methods and process of research?
(A) Descriptive survey and impact studies
(B) Experimental and observation-based studies
(C) Ethnography and phenomenology
(D) Ex-post facto and historical studies

23. Which of the following methods is used in empirical researches?
(A) Inductive method (B) Deductive method
(C) Initiative method (D) Scientific method

24. A researcher administers an achievement test to assess and indicate the possible effect of an independent variable in his/her study. The distribution of scores on the test is found to be negatively skewed. On the basis of this, what can be started with regard to the difficulty level of the test?
(A) The test is very difficult (B) The test is neither easy nor difficult
(C) The test is very easy (D) The test is easy and needs normalization

25. Which among the following is NOT related to qualitative research?
(A) Thematic analysis (B) Survey method
(C) Case study (D) Discourse analysis

26. Which of the following is a general rule of thumb for designing Questions?
(A) Never ask a closed Question.
(B) Always bear in mind your research Questions
(C) Always use vignettes rather than open Questions
(D) Use ambiguous terms to put respondents at ease

27. Probability sampling is rarely used in qualitative research because:
(A) Qualitative researchers are not trained in statistics
(B) It is often not feasible
(C) It is very old-fashioned
(D) Research Questions are more important than sampling

28. Secondary/existing data may include which of the following?
(A) Official documents (B) Personal documents
(C) Archived research data (D) All of the above

29. Which of the following is not a form of non random sampling?
(A) Snowball sampling (B) Convenience sampling
(C) Quota sampling (D) They are all forms of non-random sampling

30. Which of the following would generally require the largest sample size?
(A) Cluster sampling (B) Simple random sampling
(C) Systematic sampling (D) Proportional stratified sampling

31. The most frequently occurring number in a set of values is called the _____.
(A) Mean (B) Median
(C) Mode (D) Range

32. The mode of a distribution is 24 and the mean is 60. What is its median?
(A) 48 (B) 50
(C) 45 (D) 51

33. What is the sum of the median and mean of the following data?
56, 48, 68, 113, 180, 104, 124
(A) 203 (B) 104
(C) 5 (D) 99

34. Poisson distribution is applied for
(A) Regular Random Variable (B) Constant time function
(C) Discrete Random Variable (D) Irregular Random Variable

35. Research and Development become the index of development of country. Which of the following reasons are true with regards to this statement?
(A) All of these
(B) Because R&D targets the human development
(C) Because R&D can improve the standard of living of the people in a country
(D) Because R&D reflect the true economic and social conditions prevailing in a country

36. The longitudinal approach of research deals with _____.
(A) Short-term researches (B) Horizontal researches
(C) Long-term researches (D) None of the above

37. The word 'Anusandhan' implies _____
(A) Goal Orientation (B) Following an aim
(C) Attaining an aim (D) Praying to achieve an aim

38. If the probability of hitting a target is 0.4, find the mean and variance
(A) 0.6,0.28 (B) 0.8, 0.22
(C) 0.8, 0.20 (D) 0.6,0.24

39. What do you consider as the main aim of inter disciplinary research?
(A) To make the problem of research more complex
(B) To bring out holistic approach to research
(C) To create a new trend in research methodology
(D) To reduce the emphasis of single subject in research domain

40. Goodness of fit of a distribution is tested by
(A) t - test (B) F - test
(C) Chi - square test (D) Z – test

41. F-test is used to test the significance of the differences between/among
(A) Two sample mean (B) More than two samples mean
(C) Variance of two samples (D) (B) and (C)

42. The point where the Null Hypothesis gets rejected is called as?
(A) Significant Value (B) Rejection Value
(C) Acceptance Value (D) Critical Value

43. In systematic sampling, population is 240 and selected sample size is 60 then sampling interval is _____
(A) 240 (B) 60
(C) 4 (D) 0.25

44. Assigning numerals or other symbols to the categories or response is called
(A) Marking (B) Coding
(C) diarizing (D) tabulation

45. An example of non-personal method of Data collection is
(A) Interview (B) Group Interview
(C) Schedule (D) Telephone Interview

46. Generally variables are of
(A) Two types-Independent and dependent variable
(B) Three types-Independent, dependent and Intervening variables
(C) Four types-Independent, dependent, Intervening and control variables
(D) None of the above

47. The advantage of Random Replication Design is
(A) It controls almost all types of errors
(B) It studies the effects of the institutions simultaneously
(C) It employs in social science researches vigorously
(D) All of these

48. External validity in research refers to
(A) The rigor of the study
(B) The accuracy of a procedure
(C) The relation of the research problem with the researcher's personal life
(D) The extent of generalizability that the results provide

49. In Data Processing, what does the abbreviation SAP stand for?
(A) Systems, Applications, Products
(B) Sales, Allocations, Purchases
(C) Systems, Authorizations, Programs
(D) Systems, Algorithms, Processes

50. The normal probability curve should be.
(A) Positively Skewed
(B) Negatively Skewed
(C) Leptokurtic Skewed
(D) Zero Skewed

Part B
Computer Science

51. In LISP, the function (minusp (-20 4 8 8 1) returns
(A) T (B) F
(C) NIL (D) -20

52. Which approach to speech recognition avoids the problem caused by the variation in speech patterns among different speakers?
(A) Continuous speech recognition (B) Isolated word recognition
(C) Connected word recognition (D) Speaker-dependent recognition

53. In LISP, the function _____ returns t if <object> is a CONS cell and nil otherwise:
(A) (cons <object>) (B) (consp <object>)
(C) (eq <object>) (D) (cous = <object>)

54. Prior to the invention of time-sharing, the prevalent method of computer access was:
(A) Batch processing (B) Telecommunication
(C) Remote access (D) All of the above

55. The simplified SOP (Sum of Product) form of the Boolean expression
(P + Q' + R').(P + Q' + R).(P + Q + R') is
(A) (P'Q + R') (B) (P + Q'R')
(C) (P'Q + R) (D) (PQ + R)

56. Let P be a regular language and Q be a context-free language such that Q⊆ P. Then which of the following is ALWAYS regular?
(A) P∩ Q (B) P– Q
(C) ∑ *– P (D) ∑ *– Q

57. Which of the following statements is/are FALSE?
i. For every non-deterministic Turing machine, there exists an equivalent deterministic Turing machine
ii. Turing recognizable languages are closed under union and complementation
iii. Turing decidable languages are closed under intersection and complementation
iv. Turing recognizable languages are closed under union and intersection.
(A) i & iv only (B) i & iii only
(C) ii only (D) iii only

58. Which of the following problems are decidable?
1. Does a given program ever produce an output?
2. If L is a context-free language, then, is L' also context-free?
3. If L is a regular language, then, is L' also regular?
4. If L is a recursive language, then, is L' also recursive?
(A) 1, 2, 3 ,4 (B) 1, 2
(C) 2, 3, 4 (D) 3 ,4

59. What is KDD in data mining?
(A) Knowledge Discovery Database (B) Knowledge Discovery Data
(C) Knowledge Data definition (D) Knowledge data house

60. Consider the regular expression (0+1)(0+1).....n times. The minimum state finite automation that recognizes the language represented by this regular expression contains:
(A) n state (B) n + 1 state
(C) n + 2 state (D) None of the above

61. Consider the following Boolean expression for
F: F (P, Q, R, S) = PQ+P'QR + P'QR'S.
The minimal sum-of-products form of F is
(A) PQ + QR +QS (B) P + Q + R + S
(C) P' + Q' + R' + S' (D) P'R + P'R'S + P

62. Which of the following options represent the synchronous control inputs in an S – R flip flop?
(A) S (B) R
(C) Clock (D) Both S and R

63. Which of these error-detecting codes enables to find double errors in Digital Electronic devices?
(A) Parity method (B) Checksum method
(C) Bit generation method (D) Odd-Even method

64. A system has 6 identical resources and N processes competing for them. Each process can request at most 2 resources. Which one of the following values of N could lead to a deadlock?
(A) 1 (B) 2
(C) 3 (D) 6

65. What is a long-term scheduler?
(A) It selects processes which have to be brought into the ready queue
(B) It selects processes which have to be executed next and allocates CPU
(C) It selects processes which heave to remove from memory by swapping
(D) None of the mentioned

66. Consider the following statements about process state transitions for a system using preemptive scheduling.

I. A running process can move to ready state.
II. A ready process can move to ready state.
III. A blocked process can move to running state.
IV. A blocked process can move to ready state.

Which of the above statements are TRUE?

(A) I, II & III ONLY
(B) II & III ONLY
(C) I, II & IV ONLY
(D) I, II, III & IV

67. In which one of the following page replacement algorithms it is possible for the page fault rate to increase even when the number of allocated frames increases?
(A) LRU (Least Recently Used)
(B) OPT (Optimal Page Replacement)
(C) MRU (Most Recently Used)
(D) FIFO (First In First Out)

68. A system has 12 magnetic tape drives and 3 processes : P0, P1, and P2. Process P0 requires 10 tape drives, P1 requires 4 and P2 requires 9 tape drives.

Process	Maximum needs	Currently allocated
P0	10	5
P1	4	2
P2	9	2

Which of the following sequence is a safe sequence?
(A) P0, P1, P2
(B) P1, P2, P0
(C) P2, P0, P1
(D) P1, P0, P2

69. Which one of the following kinds of derivation is used by LR parsers?
(A) Leftmost
(B) Leftmost in reverse
(C) Rightmost
(D) Rightmost in reverse

70. Match all items in Group 1 with correct options from those given in Group 2.

Group 1	Group 2
P. Regular expression	1. Syntax analysis
Q. Pushdown automata	2. Code generation
R. Dataflow analysis	3. Lexical analysis
S. Register allocation	4. Code optimization

(A) P-4. Q-1, R-2, S-3
(B) P-3, Q-1, R-4, S-2
(C) P-3, Q-4, R-1, S-2
(D) P-2, Q-1, R-4, S-3

71. Uniform symbol table _____
(A) Has all constants in the program
(B) Permanent table of rules in the form of patterns for matching with the uniform symbol table to discover syntactic structure
(C) Consists of full or partial list of the tokens as they appear in the program created by Lexical analysis and used for syntax analysis and interpretation
(D) A permanent table which has all key words and special symbols of the language in symbolic form

72. Given the language L-{ab, aa, baa}, which of the following strings are in LG?
1) abaabaaabaa
2) aaaabaaaa
3) baaaaabaaaab
4) baaaaabaa

(A) 1,2 and 3 (B) 2,3 and 4
(C) 1,2 and 4 (D) 1,3 and 4

73. Consider the following C program segment.

```
#include < stdio.h >
int main()
{
        char s1[7] = "1234", *p;
        p = s1 + 2;
 *p = '0';
        printf("%s", s1);
}
```

What will be printed by the program?

(A) 12 (B) 120400
(C) 1204 (D) 1034

74. What is printed by the following ANSI C program?

```
#include <stdio.h>
int main(int argc, char *argv[ ]) {
 int x = 1, z[2] = {10, 11};
 int *p = NULL;
 p = &x;
 *p = 10;
 p = &z[1];
 *(&z[0] + 1) += 3;
 printf("%d, %d, %d\n", x, z[0], z[1]);
 return 0;
}
```

(A) 1, 10, 11 (B) 1, 10, 14
(C) 10, 14, 11 (D) 10, 10, 14

75. On which of the following approach A basic line following robot is based?
(A) Applied approach (B) Weak approach
(C) Strong approach (D) Cognitive approach

76. Consider the C function given below.

```
int f(int j)
{
        static int i = 50;
        int k;
        if (i == j)
        {
        printf("something");
        k = f(i);
        return 0;
        }
        else return 0;
}
```

Which one of the following is TRUE?

(A) The function returns 0 for all values of j.
(B) The function prints the string something for all values of j.
(C) The function returns 0 when j = 50.
(D) The function will exhaust the runtime stack or run into an infinite loop when j = 50

77. An index is clustered, if
(A) it is on a set of fields that form a candidate key.
(B) it is on a set of fields that include the primary key.
(C) the data records of the file are organized in the same order as the data entries of the index.
(D)

78. SQL allows duplicate tuples in relations, and correspondingly defines the multiplicity of tuples in the result of joins. Which one of the following queries always gives the same answer as the nested query shown below:
Select * from R where a in (select S.a from S)
(A) select R.* from R, S where R.a=S.a
(B) select distinct R.* from R,S where R.a=S.a
(C) select R.* from R,(select distinct a from S) as S1 where R.a=S1.a
(D) select R.* from R,S where R.a=S.a and is unique

79. Which one of the following is NOT a part of the properties of database transactions?
(A) Atomicity
(B) Consistency
(C) Isolation
(D) Deadlock-freedom

80. Consider the following transaction involving two bank accounts x and y.
read(x); x := x – 50; write(x); read(y); y := y + 50; write(y)
The constraint that the sum of the accounts x and y should remain constant is that of
(A) Atomicity (B) Consistency
(C) Isolation (D) Durability

81. Assume that source S and destination D are connected through two intermediate routers labeled R. Determine how many times each packet has to visit the network layer and the data link layer during a transmission from S to (D)
(A) Network layer – 4 times and Data link layer – 4 times
(B) Network layer – 4 times and Data link layer – 3 times
(C) Network layer – 4 times and Data link layer – 6 times
(D) Network layer – 2 times and Data link layer – 6 times

82. The protocol data unit (PDU) for the application layer in the Internet stack is
(A) Segment (B) Datagram
(C) Message (D) Frame

83. Consider the following statements about the functionality of an IP based router.
I. A router does not modify the IP packets during forwarding.
II. It is not necessary for a router to implement any routing protocol.
III. A router should reassemble IP fragments if the MTU of the outgoing link is larger than the size of the incoming IP packet.

Which of the above statements is/are TRUE?

(A) I and II only (B) I only
(C) II and III only (D) II only

84. Which one of the following protocols is NOT used to resolve one form of address to another one?
(A) DNS (B) ARP
(C) DHCP (D) RARP

85. Suppose that everyone in a group of N people wants to communicate secretly with the N-1 others using symmetric key cryptographic system. The communication between any two persons should not be decodable by the others in the group. The number of keys required in the system as a whole to satisfy the confidentiality requirement is
(A) N(N – 1)/2 (B) 2N
(C) N(N – 1) (D) (N – 1)2

86. The copy-back protocol is used _____
(A) To copy the contents of the memory onto the cache
(B) To update the contents of the memory from the cache
(C) To remove the contents of the cache and push it on to the memory
(D) None of these

87. The starting address of the page table is stored in _____
(A) TLB
(B) R0
(C) Page table base register
(D) None of the mentioned

88. Which of the following device should get higher priority on assigning interrupts?
(A) Printer
(B) Hard disk
(C) Keyboard
(D) Floppy disk

89. Register renaming is done in pipelined processors
(A) as an alternative to register allocation at compile time
(B) for efficient access to function parameters and local variables
(C) to handle certain kinds of hazards
(D) as part of address translation

90. A CPU generally handles an interrupt by executing an interrupt service routine
(A) As soon as an interrupt is raised
(B) By checking the interrupt register at the end of fetch cycle.
(C) By checking the interrupt register after finishing the execution of the current instruction.
(D) By checking the interrupt register at fixed time intervals.

91. PCA is
(A) forward feature selection
(B) backword feature selection
(C) feature extraction
(D) all of the above

92. Consider the following expressions:
(i) false
(ii) Q
(iii) true
(iv) $P \vee Q$
(v) $\neg Q \vee P$
The number of expressions given above that are logically implied by $P \wedge (P \Rightarrow Q)$ is
(A) 2
(B) 3
(C) 4
(D) 5

93. Consider the following two statements.
S1: If a candidate is known to be corrupt, then he will not be elected
S2: If a candidate is kind, he will be elected
Which one of the following statements follows from S1 and S2 as per sound inference rules of logic?

(A) If a person is known to be corrupt, he is kind
(B) If a person is not known to be corrupt, he is not kind
(C) If a person is kind, he is not known to be corrupt
(D) If a person is not kind, he is not known to be corrupt

94. The "curse of dimensionality" referes
(A) all the problems that arise when working with data in the higher dimensions, that did not exist in the lower dimensions.
(B) all the problems that arise when working with data in the lower dimensions, that did not exist in the higher dimensions.
(C) all the problems that arise when working with data in the lower dimensions, that did not exist in the lower dimensions.
(D) all the problems that arise when working with data in the higher dimensions, that did not exist in the higher dimensions.

95. Support Vector Machine is
(A) logical model
(B) proabilistic model
(C) geometric model
(D) none of the above

96. The complexity of Travelling Salesperson problem using dynamic programming is
(A) $O(n^2 \times 2^n)$
(B) O(nlogn)
(C) Theta(nlogn)
(D) $O(n^3)$

97. Calculating the chromatic number of a graph is a
(A) P problem
(B) NP hard problem
(C) NP complete problem
(D) cannot be identified as any of the given problem types

98. What is a randomized QuickSort?
(A) The leftmost element is chosen as the pivot
(B) The rightmost element is chosen as the pivot
(C) Any element in the array is chosen as the pivot
(D) A random number is generated which is used as the pivot

99. While inserting the elements 71, 65, 84, 69, 67, 83 in an empty binary search tree (BST) in the sequence shown, the element in the lowest level is
(A) 65
(B) 67
(C) 69
(D) 83

100. What is the auxiliary space complexity of merge sort?
(A) O(1)
(B) O(log n)
(C) O(n)
(D) O(n log n)

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