

UNIVERSITY OF MYSORE

Ph.D. Entrance Examination, November - 2020



SUBJECT CODE :

15

QUESTION BOOKLET NO.

Entrance Reg. No.

502653

QUESTION BOOKLET

(Read carefully the instructions given in the Question Booklet)

SUBJECT :

COMPUTER SCIENCE

MAXIMUM MARKS : 100

MAXIMUM TIME : THREE HOURS

(Including initial 10 minutes for filling O.M.R. Answer sheet)

INSTRUCTIONS TO THE CANDIDATES

1. The sealed questions booklet containing 50 questions enclosed with O.M.R. Answer Sheet is given to you.
2. Verify whether the given question booklet is of the same subject which you have opted for examination.
3. Open the question paper seal carefully and take out the enclosed O.M.R. Answer Sheet outside the question booklet and fill up the general information in the O.M.R. Answer sheet. If you fail to fill up the details in the form of alphabet and signs as instructed, you will be personally responsible for consequences arising during scoring of your Answer Sheet.
4. During the examination:
 - a) Read each question carefully.
 - b) Determine the Most appropriate/correct answer from the four available choices given under each question.
 - c) Completely darken the relevant circle against the Question in the O.M.R. Answer Sheet. For example, in the question paper if "C" is correct answer for Question No.8, then darken against Sl. No.8 of O.M.R. Answer Sheet using Blue/Black Ball Point Pen as follows:

Question No. 8. (A) (B) (C) (D) (Only example) (Use Ball Pen only)

5. Rough work should be done only on the blank space provided in the Question Booklet. Rough work should not be done on the O.M.R. Answer Sheet.
6. If more than one circle is darkened for a given question, such answer is treated as wrong and no mark will be given. See the example in the O.M.R. Sheet.
7. The candidate and the Room Supervisor should sign in the O.M.R. Sheet at the specified place.
8. Candidate should return the original O.M.R. Answer Sheet and the university copy to the Room Supervisor after the examination.
9. Candidate can carry the question booklet and the candidate copy of the O.M.R. Sheet.
10. The calculator, pager and mobile phone are not allowed inside the examination hall.
11. **If a candidate is found committing malpractice, such a candidate shall not be considered for admission to the course and action against such candidate will be taken as per rules.**

INSTRUCTIONS TO FILL UP THE O.M.R. SHEET

1. There is only one most appropriate/correct answer for each question.
2. For each question, only one circle must be darkened with BLUE or BLACK ball point pen only. Do not try to alter it.
3. Circle should be darkened completely so that the alphabet inside it is not visible.
4. Do not make any stray marks on O.M.R. Sheet.

ಗಮನಿಸಿ : ಸೂಚನೆಗಳ ಕನ್ನಡ ಆವೃತ್ತಿಯು ಈ ಮಸ್ತಕದ ಹಿಂಭಾಗದಲ್ಲಿ ಮುದ್ರಿಸಲ್ಪಟ್ಟಿದೆ.

PART - A

This part shall contains 50 multiple choice/objective type questions, each question carrying one mark. [50 × 1 = 50]

- 1) Let G be a complete undirected graph on 6 vertices. If vertices of G are labeled, then the number of distinct cycles of length 4 in G is equal to
- (A) 45 (B) 30
(C) 90 (D) 360
- 2) If A and B are any two non-empty subsets of a set E, then what is $A \cup (A \cap B)$?
- (A) $A \cup B$ (B) $A \cap B$
(C) A (D) B
- 3) What is the possible number of reflexive relations on a set of 5 elements
- (A) 2^{10} (B) 2^{15}
(C) 2^{20} (D) 2^{25}
- 4) Let G be finite group on 84 elements. The size of a largest possible proper subgroup G is
- (A) 24 (B) 42
(C) 84 (D) 12
- 5) $PV(p \rightarrow q) \vee [\sim(p \wedge q)]$ is _____
- (A) Tautology (B) Contradiction
(C) Contingency (D) None of A, B, C
- 6) In a microprocessor system with memory mapped I/O
- (A) Devices have 8-bit addresses
(B) Devices are accessed using IN and OUT instructions
(C) There can be a maximum of 256 input devices and 256 output devices
(D) Arithmetic and logic operations can be directly performed with the I/O data

7) If we use 3 bits in the instruction word to indicate, if an index register is to be used and if necessary, which one is to be used, then the number of index registers to be used in the machine will be

- (A) 3 (B) 6
(C) 5 (D) 8

8) Which is the most appropriate match for the items in List I with the items in List II?

List I

- A) Indirect Addressing
B) Indexed Addressing
C) Base Register Addressing

List II

- 1) Array implementation
2) Writing relocatable code
3) Parsing array as parameter

Codes : A B C

- (A) 3 1 2 (B) 2 3 1
(C) 3 2 1 (D) 1 2 3

9) The number of instructions needed to add 'n' numbers and store the result in memory using only one address instructions is

- (A) n (B) n+1
(C) n-1 (D) independent of n

10) Serial input data of 8085 can be loaded into bit 7 of the accumulator by

- (A) Executing a RIM instruction (B) Executing RST 1
(C) Using RESET (D) None of A, B, C

11) The output of the c/c++ program segment

```
int x=025;  
printf("%d",x)
```

- (A) 25 (B) 025
(C) Error (D) 21

12) The output of the c/c++ program segment is

```
int m,n;  
m=5;  
n=m++;  
printf("m=%d n=%d\n",m,n);
```

(A) m=5 n=5

(B) m=6 n=5

(C) m=6 n=6

(D) m=5 n=6

13) The evaluation result of the c/c++ arithmetic expression

```
int k = -8%3*2+5%8*2+5/2*2
```

(A) 18

(B) 8

(C) 14

(D) 19

14) Function overloading is a case of

(A) dynamic/late binding

(B) inheritance

(C) static/early binding

(D) encapsulation

15) Generic programming is developed in c++ using

(A) classes

(B) templates

(C) objects

(D) methods

16) Data independence means

(A) data is defined separately and not included in programs

(B) programs are not dependent on the physical attributes of data

(C) programs are not dependent on the logical attributes of data

(D) programs are not dependent on both physical and logical attributes of data

17) The number of tuples in a relation is called its _____ while the number of attributes in a relation is called it's _____

(A) Degree, Cardinality

(B) Cardinality, Degree

(C) Rows, Columns

(D) Columns, Rows

18) The language that requires a user to specify the data to be retrieved without specifying exactly how to get it is

- (A) Procedural DML (B) Non-Procedural DML
(C) Procedural DDL (D) Non-Procedural DDL

19) A relation is in _____ if an attribute of a composite key is dependent on an attribute of another composite key.

- (A) 2NF (B) 3NF
(C) BCNF (D) 1NF

20) Consider the tables A, B and C, given below

Table A	Table B	Table C
Id Name Age	Id Name Age	Id Phone Area
-----	-----	-----
12 Arun 60	15 Shreya 24	10 2200 02
15 Shreya 24	25 Hari 40	99 2100 01
99 Rohit 11	98 Rohit 20	
	99 Rohit 11	

How many tuples does the result of the following SQL query contains?

```
SELECT A.id
FROM A
WHERE A.age > ALL (SELECT B.age
                  FROM B
                  WHERE B.name = "arun")
```

- (A) 4 (B) 3
(C) 0 (D) 1

21) Recursion is an application of

- (A) queue (B) graph
(C) tree (D) stack

- 22) Collisions in hash table are resolved through
- (A) recursion (B) overloading
(C) linear probing (D) overriding
- 23) The recursive approaches are _____ than/to iterative approaches
- (A) faster (B) slower
(C) equal (D) None of A, B, C
- 24) In index sequential files, the new records are inserted into _____ area
- (A) prime (B) index
(C) overflow (D) folder
- 25) A depth first search in graph employs _____ data structure
- (A) tree (B) graph
(C) queue (D) stack
- 26) Compression is the task of _____ layer in ISO OSI network model.
- (A) Session (B) Presentation
(C) Transport (D) Application
- 27) If all nodes are connected to a single central node, then it is _____ topology
- (A) Hybrid (B) Ring
(C) Mesh (D) Star
- 28) FDDI stands for
- (A) Fiber Distributed Data Interface
(B) Fiber Data Distributed Interface
(C) Fiber Dual Distributed Interface
(D) Fiber Dual Data Interface

- 29) Which of the following is not the speed of any ethernet.
- (A) 100 Mbps (B) 1000 Mbps
(C) 10Gbps (D) 100 Gbps
- 30) Five channels, each with a 100 kHz bandwidth, are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of 10 kHz between the channels to prevent interference.
- (A) 110 kHz (B) 500 kHz
(C) 540 kHz (D) None of A, B, C
- 31) Macro processor is an inbuilt function of _____
- (A) Assembler (B) Loader
(C) Linker (D) Editor
- 32) Assembler is a program that
- (A) places programs into memory and prepares them for execution
(B) appears to execute a source program as if it were machine language
(C) automate the translation of assembly language into machine language
(D) accepts a program in high level language and produces an object program
- 33) In a compiler keywords of language are recognized during
- (A) The code generation (B) Parsing of the program
(C) Lexical Analysis of program (D) Data flow analysis
- 34) In a two-pass assembler, symbol table is
- (A) Generated in first pass
(B) Generated in second pass
(C) Generated and used only in second pass
(D) Not generated at all

- 35) A context free language is called ambiguous if it has
- (A) two or more leftmost derivations for some terminal string $w \in L(G)$
 - (B) Itwo or more leftmost derivations for some terminal string $w \in L(G)$
 - (C) Both (A) and (B)
 - (D) None of A, B, C
- 36) Which of the following features of UNIX may be used for inter process communication?
- (A) Signals
 - (B) Pipes
 - (C) Semaphore
 - (D) All of these
- 37) In a system, if 5 people are currently using the vi editor. then the number of corresponding processes will be
- (A) 1
 - (B) 5
 - (C) 2
 - (D) 0
- 38) Memory management technique in which system stores and retrieves data from secondary storage for use in main memory is called:
- (A) Fragmentation
 - (B) Paging
 - (C) Mapping
 - (D) None of the mentioned
- 39) To simulate the command "system". Which of the system calls - fork, wait and excel is to be used?
- (A) fork and wait
 - (B) all three
 - (C) fork and excel
 - (D) wait and excel
- 40) Which of the following is not filter in **unix**?
- (A) Cat
 - (B) Head
 - (C) Tail
 - (D) Cd

- 41) All the modules of the system are integrated and tested as complete system in the case of
- (A) Bottom up testing (B) Top-down testing
(C) Sandwich testing (D) Big-Bang testing
- 42) Structured charts are a product of
- (A) requirements gathering (B) requirements analysis
(C) design (D) coding
- 43) In size oriented metrics, metrics are developed based on
- (A) number of user inputs (B) number of lines of code
(C) number of functions (D) amount of memory usage
- 44) The process of digitizing a given picture definition into a set of pixel-intensity for storage in the frame buffer is called
- (A) Rasterization (B) Encoding
(C) Scan conversion (D) True color system
- 45) Shearing is also termed as
- (A) Selecting (B) Sorting
(C) Scaling (D) Skewing
- 46) The time complexity of heap sort algorithm is
- (A) $O(n)$ (B) $O(n^2)$
(C) $O(\log n)$ (D) $O(n \log n)$
- 47) Fractional knapsack problem is solved most efficiently by which of the following algorithm?
- (A) divide and conquer (B) dynamic programming
(C) greedy (D) back tracking

- 48) Which of the algorithm can be used to solve Hamiltonian path problem efficiently?
- (A) branch and bound (B) dynamic programming
(C) divide and conquer (D) greedy
- 49) What is the time complexity of the recursive implementation used to find the n^{th} Fibonacci term?
- (A) $O(1)$ (B) $O(n^2)$
(C) $O(n!)$ (D) Exponential
- 50) Which of the following is/are property/properties of a dynamic programming problem?
- (A) optimal substructure
(B) overlapping subproblems
(C) greedy
(D) optimal substructure and overlapping subproblems

PART - B

This part shall contains ten questions, each question carrying five marks.

[10 × 5 = 50]

- 1) State and prove generalized pigeon hole principle.
- 2) Perform the arithmetic operations below with binary numbers and with negative numbers in signed-2's complement representation. Use seven bits to accommodate each number together with its sign. In each case, determine if there is an overflow by checking the carries into and out of the sign bit position.
 - a) $(+35) + (+40)$
 - b) $(-35) + (-40)$
 - c) $(+35) + (-40)$

- 3) Define a c/c++ function to compute $\sqrt{x + y + z}$ and use the function in a main function to compute

$$p = \sqrt{a + b + c}$$

$$q = \sqrt{3a + 2b + 4c}$$

$$r = \sqrt{a + b + \sqrt{a + b + c}}$$

$$s = (a + b + c)^{3/2}$$

- 4) Write an E-R Diagram for Bank Database by considering minimum 4 Entities.
- 5) Write an algorithm to remove the node with the smallest value in a binary search tree.
- 6) Define Cyclic Code. Find the codeword using CRC for a given dataword 101001111 and generator (Divisor) 10111.

7) Consider the grammar

$$S \rightarrow S + S$$

$$S \rightarrow S * S$$

$$S \rightarrow id$$

Perform Shift Reduce parsing for input string "id + id + id".

8) Use the safety algorithm to test if the system is in a safe state or not?

a) We will first define work and finish:

Initially work = available = (1, 5, 2, 0)

Finish = False for all processes

Finish matrix	
P ₀	False
P ₁	False
P ₂	False
P ₃	False
P ₄	False

Work vector			
1	5	2	0

b) Check the needs of each process [$needs(pi) \leq Max(pi)$], if this condition is true :

- Execute the process , Change Finish [i] =True
- Release the allocated Resources by this process
- Change The Work Variable = Allocated (pi) + Work

9) Explain the prototype model in SDLC.

10) Write the quick sort algorithm and illustrate the same to sort the data instance [8, 21, 15, 12, 32, 6, 27, 19]



ಅಭ್ಯರ್ಥಿಗಳಿಗೆ ಸೂಚನೆಗಳು

1. ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಹಾಳೆಯ ಜೊತೆಗೆ 50 ಪ್ರಶ್ನೆಗಳನ್ನು ಹೊಂದಿರುವ ಮೊಹರು ಮಾಡಿದ ಪ್ರಶ್ನೆ ಪುಸ್ತಕವನ್ನು ನಿಮಗೆ ನೀಡಲಾಗಿದೆ.
2. ಕೊಟ್ಟಿರುವ ಪ್ರಶ್ನೆ ಪುಸ್ತಕವು, ನೀವು ಪರೀಕ್ಷೆಗೆ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡಿರುವ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದ್ದೇ ಎಂಬುದನ್ನು ಪರಿಶೀಲಿಸಿರಿ.
3. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ಮೊಹರು ಜಾಗ್ರತೆಯಿಂದ ತೆರೆಯಿರಿ ಮತ್ತು ಪ್ರಶ್ನೆಪತ್ರಿಕೆಯಿಂದ ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಹಾಳೆಯನ್ನು ಹೊರಗೆ ತೆಗೆದು, ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಹಾಳೆಯಲ್ಲಿ ಸಾಮಾನ್ಯ ಮಾಹಿತಿಯನ್ನು ತುಂಬಿರಿ. ಕೊಟ್ಟಿರುವ ಸೂಚನೆಯಂತೆ ನೀವು ನಮೂನೆಯಲ್ಲಿನ ವಿವರಗಳನ್ನು ತುಂಬಲು ವಿಫಲರಾದರೆ, ನಿಮ್ಮ ಉತ್ತರ ಹಾಳೆಯ ಮೌಲ್ಯಮಾಪನ ಸಮಯದಲ್ಲಿ ಉಂಟಾಗುವ ಪರಿಣಾಮಗಳಿಗೆ ವೈಯಕ್ತಿಕವಾಗಿ ನೀವೇ ಜವಾಬ್ದಾರಾಗಿರುತ್ತೀರಿ.
4. ಪರೀಕ್ಷೆಯ ಸಮಯದಲ್ಲಿ:
 - a) ಪ್ರತಿಯೊಂದು ಪ್ರಶ್ನೆಯನ್ನು ಜಾಗ್ರತೆಯಿಂದ ಓದಿರಿ.
 - b) ಪ್ರತಿ ಪ್ರಶ್ನೆಯ ಕೆಳಗೆ ನೀಡಿರುವ ನಾಲ್ಕು ಲಭ್ಯ ಆಯ್ಕೆಗಳಲ್ಲಿ ಅತ್ಯಂತ ಸರಿಯಾದ/ ಸೂಕ್ತವಾದ ಉತ್ತರವನ್ನು ನಿರ್ಧರಿಸಿ.
 - c) ಓ.ಎಂ.ಆರ್. ಹಾಳೆಯಲ್ಲಿನ ಸಂಬಂಧಿಸಿದ ಪ್ರಶ್ನೆಯ ವೃತ್ತಾಕಾರವನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ತುಂಬಿರಿ. ಉದಾಹರಣೆಗೆ, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿ ಪ್ರಶ್ನೆ ಸಂಖ್ಯೆ 8ಕ್ಕೆ "C" ಸರಿಯಾದ ಉತ್ತರವಾಗಿದ್ದರೆ, ನೀಲಿ/ಕಪ್ಪು ಬಾಲ್ ಪಾಯಿಂಟ್ ಪೆನ್ ಬಳಸಿ ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಹಾಳೆಯ ಕ್ರಮ ಸಂಖ್ಯೆ 8ರ ಮುಂದೆ ಈ ಕೆಳಗಿನಂತೆ ತುಂಬಿರಿ:
 ಪ್ರಶ್ನೆ ಸಂಖ್ಯೆ 8(A) (B) (C) (D) (ಉದಾಹರಣೆ ಮಾತ್ರ) (ಬಾಲ್ ಪಾಯಿಂಟ್ ಪೆನ್ ಮಾತ್ರ ಉಪಯೋಗಿಸಿ)
5. ಉತ್ತರದ ಪೂರ್ವಸಿದ್ಧತೆಯ ಬರವಣಿಗೆಯನ್ನು (ಚಿತ್ತು ಕೆಲಸ) ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿ ಒದಗಿಸಿದ ಖಾಲಿ ಜಾಗದಲ್ಲಿ ಮಾತ್ರವೇ ಮಾಡಬೇಕು (ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಹಾಳೆಯಲ್ಲಿ ಮಾಡಬಾರದು).
6. ಒಂದು ನಿರ್ದಿಷ್ಟ ಪ್ರಶ್ನೆಗೆ ಒಂದಕ್ಕಿಂತ ಹೆಚ್ಚು ವೃತ್ತಾಕಾರವನ್ನು ಗುರುತಿಸಲಾಗಿದ್ದರೆ, ಅಂತಹ ಉತ್ತರವನ್ನು ತಪ್ಪು ಎಂದು ಪರಿಗಣಿಸಲಾಗುತ್ತದೆ ಮತ್ತು ಯಾವುದೇ ಅಂಕವನ್ನು ನೀಡಲಾಗುವುದಿಲ್ಲ. ಓ.ಎಂ.ಆರ್. ಹಾಳೆಯಲ್ಲಿನ ಉದಾಹರಣೆ ನೋಡಿ.
7. ಅಭ್ಯರ್ಥಿ ಮತ್ತು ಕೊಠಡಿ ಮೇಲ್ವಿಚಾರಕರು ನಿರ್ದಿಷ್ಟಪಡಿಸಿದ ಸ್ಥಳದಲ್ಲಿ ಓ.ಎಂ.ಆರ್. ಹಾಳೆಯ ಮೇಲೆ ಸಹಿ ಮಾಡಬೇಕು.
8. ಅಭ್ಯರ್ಥಿಯು ಪರೀಕ್ಷೆಯ ನಂತರ ಕೊಠಡಿ ಮೇಲ್ವಿಚಾರಕರಿಗೆ ಮೂಲ ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಹಾಳೆ ಮತ್ತು ವಿಶ್ವವಿದ್ಯಾನಿಲಯದ ಪ್ರತಿಯನ್ನು ಹಿಂದಿರುಗಿಸಬೇಕು.
9. ಅಭ್ಯರ್ಥಿಯು ಪ್ರಶ್ನೆ ಪುಸ್ತಕವನ್ನು ಮತ್ತು ಓ.ಎಂ.ಆರ್. ಅಭ್ಯರ್ಥಿಯ ಪ್ರತಿಯನ್ನು ತಮ್ಮ ಜೊತೆ ತೆಗೆದುಕೊಂಡು ಹೋಗಬಹುದು.
10. ಕ್ಯಾಲ್ಕುಲೇಟರ್, ಪೇಜರ್ ಮತ್ತು ಮೊಬೈಲ್ ಫೋನ್‌ಗಳನ್ನು ಪರೀಕ್ಷಾ ಕೊಠಡಿಯ ಒಳಗೆ ಅನುಮತಿಸಲಾಗುವುದಿಲ್ಲ.
11. ಅಭ್ಯರ್ಥಿಯು ದುಷ್ಕೃತ್ಯದಲ್ಲಿ ತೊಡಗಿರುವುದು ಕಂಡುಬಂದರೆ, ಅಂತಹ ಅಭ್ಯರ್ಥಿಯನ್ನು ಕೋರ್ಸ್‌ಗೆ ಪರಿಗಣಿಸಲಾಗುವುದಿಲ್ಲ ಮತ್ತು ನಿಯಮಗಳ ಪ್ರಕಾರ ಇಂತಹ ಅಭ್ಯರ್ಥಿಯ ವಿರುದ್ಧ ಕ್ರಮ ಕೈಗೊಳ್ಳಲಾಗುವುದು.
 ಓ.ಎಂ.ಆರ್. ಹಾಳೆಯನ್ನು ತುಂಬಲು ಸೂಚನೆಗಳು

1. ಪ್ರತಿಯೊಂದು ಪ್ರಶ್ನೆಗೆ ಒಂದೇ ಒಂದು ಅತ್ಯಂತ ಸೂಕ್ತವಾದ/ಸರಿಯಾದ ಉತ್ತರವಿರುತ್ತದೆ.
2. ಪ್ರತಿ ಪ್ರಶ್ನೆಗೆ ಒಂದು ವೃತ್ತವನ್ನು ಮಾತ್ರ ನೀಲಿ ಅಥವಾ ಕಪ್ಪು ಬಾಲ್ ಪಾಯಿಂಟ್ ಪೆನ್ನಿನಿಂದ ಮಾತ್ರ ತುಂಬತಕ್ಕದ್ದು. ಉತ್ತರವನ್ನು ಮಾರ್ಪಡಿಸಲು ಪ್ರಯತ್ನಿಸಬೇಡಿ.
3. ವೃತ್ತದೊಳಗಿರುವ ಅಕ್ಷರವು ಕಾಣದಿರುವಂತೆ ವೃತ್ತವನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ತುಂಬುವುದು.
4. ಓ.ಎಂ.ಆರ್. ಹಾಳೆಯಲ್ಲಿ ಯಾವುದೇ ಅನಾವಶ್ಯಕ ಗುರುತುಗಳನ್ನು ಮಾಡಬೇಡಿ.

Note : English version of the instructions is printed on the front cover of this booklet.