Ph.D. Programme in Computer Science

Model Question Paper

RESEARCH APTITUDE ASSESSMENT TEST

Time : 2 Hours **Max. Marks : 75**

I. Part A: Multiple Choice Questions 30 x 1 mark = 30 marks

Choose the correct Response viz., A, B, C, D or E for the Questions from 1 - 30 which carry ONE mark each. Please NOTE that an **incorrect response** will attract **negative marking**. (For Multiple Choice question with 5 options, ¼th mark shall be deducted for an incorrect answer.)

1. 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)
E) LFU (Least Frenquently Used)

2. Assume that for a certain processor, a read request takes 50 nanoseconds on a cache miss and 5 nanoseconds on a cache hit. Suppose while running a program, it was observed that 80% of the processors read requests result in a cache hit. The average access time in nanoseconds is _____.

( )

A) 10 ns B) 12 ns C) 14 ns D) 16 ns E) 18 ns

3. A computer system has 6 tape drives, with 'n' processes competing for them. Each process may need 3 tape drives. The maximum value of 'n' for which the system is guaranteed to be deadlock free is

( )

A) 1 B) 2 C) 3 D) 4 E) 8

4. A processor has 40 distinct instructions and 24 general purpose registers. A 32-bit instruction word has an opcode, two register operands and an immediate operand. The number of bits available for the immediate operand field is

( )

A) 10 B) 12 C.14 D) 16 D) 18

5. Consider the following two-process synchronization solution.

Process 0 ---------	Process 1 ----------
Entry: loop while (turn == 1);	Entry: loop while (turn == 0);
(critical section)	(critical section)
Exit: turn = 1;	Exit: turn = 0;

The shared variable turn is initialized to zero. Which one of the following is TRUE?

A) This is a correct two-process synchronization solution.
B) This solution violates mutual exclusion requirement.
C) This solution violates progress requirement.
D) This solution violates bounded wait requirement.
E) None of the above

6. A process executes the code
fork (); fork (); fork ();
The total number of child processes created is

( )

A) 3 B) 4 C) 7 D) 8 E) 10

7. The prefix and postfix forms of the expression A-B*C+D is:

( )

A) – A B * C D + and ABC*D-+ B) * – A B C D + and AB-C*D+
C) + – A * B C D and ABC*-D+ D) + – * A B C D and ABCD*-+
E) None of the above

8. Using a singly linked list to maintain a queue with front and rear pointers, the following three operations take these amounts of time correspondingly: O(1), O(N), O(N)

( )

A) Insert First, Delete Last, Print all elements
B) Insert Last, Print Reverse, Find an element
C) Print in reverse, Delete First, Delete Last
D) Find an element, Print Reverse, Delete First
E) None of the above

9. The minimum number of pointers needed to build a node in a general tree (a tree where a node can have any number of children) is:

( )

A) 2 B) Not possible C) 3 D) 1 E) Infinity

10. Insert a node and search for a node in a binary search tree take the following time: ( )

A) O(logN) and O(N) B) O(N) and O(logN)
C) O(2^N) and O(N) D) O(logN) and O(logN)
E) None of the above

11. For a C++ class, Which one of the following is true? ( )

A) One constructor allowed but virtual destructor not allowed
B) One virtual destructor and multiple constructors allowed
C) Virtual constructors allowed but only one destructor
D) Multiple constructors and multiple destructors allowed
E) None of the above

12. Let R be the relation on the set of positive integers such that aRb if and only if a and b are distinct and have a common divisor other than 1. Which one of the following statements about R is true? ( )

A) R is symmetric and reflexive but not transitive
B) R is reflexive but not symmetric and not transitive
C) R is transitive but not reflexive and not symmetric
D) R is symmetric but not reflexive and not transitive
E) None of the above

13. 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 per sound interference rules of logic?

A) If a person is known to 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
E) None of the above

14. Two fair six-sided dice are rolled. The probability that the sum of the result being 7 is _____ ( )

A) 1/3 B) 1/18 C) 1/9 D) 2/3 E) 1/6

15. An Urn contains 9 balls, 2 of which are red, 3 blue and 4 black. Three balls are drawn at random. The chance that they are of the same colour is

( )

A) 5/84 B) 1/84 C) 3/84 D) 7/84 E) 9/84

16. to 30. ……

Part - B

II. Answer any 9 of the following in about 150 words each in the sheets provided with the question paper:

(9 x 5 = 45 marks)

1. Consider the following set of processes, with the length of the CPU burst given in milliseconds along with priorities. All process have arrived at the same time. For the SJF(Non-preemptive) and FCFS strategies fill up the table entries:

(2+3=5marks)

FCFS:

Process	Arrival Time	Burst Time	Priority	Finish Time	Turnaround Time	Waiting Time
P1	0	10	3			
P2	0	1	1			
P3	0	2	3			
P4	0	1	4			
P5	0	5	2			

SJF:

Process	Arrival Time	Burst Time	Priority	Finish Time	Turnaround Time	Waiting Time
P1	0	10	3			
P2	0	1	1			
P3	0	2	3			
P4	0	1	4			
P5	0	5	2			

2. What are the ways to improve Instruction Level Parallelism? Briefly discuss 2 prominent strategies employed by modern processors to improve ILP.

3. What is a relocatable program? Explain with a simple example.

4. When an integer has to use fixed limited storage like 32, 64 or 128-bits, how is it possible to store and work with extremely large astronomical numbers? Provide the idea behind the implementation and pseudo code for the multiplication operation of two such very large numbers. (2 + 3 = 5M)

5. Write a simple swap function to illustrate pass by reference in C++. Elaborate why a copy constructor uses pass by reference even though it does not affect the passed parameter. (1+4 = 5M)

6. Show that L = {w in {a, b}* | w has equal number of a's and b's} is not regular.

7. Let L be an NP-Complete language. Show that class P = class NP iff L belongs to class P.

8. to 12. …..

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