GLA University, Mathura

GLAET - M.Tech. (CSE) Model Paper

Q1: Consider the statement:

"Not all that glitters is gold"

Predicate glitters (x) is true if x glitters and predicate gold (x) is true if x is gold. Which one of the following logical formulae represents the above statement?

(A) ∀x; glitters (x) ⇒ ¬ gold (x)

(B) ∀x; gold (x) ⇒ glitters (x)

(C) ∃ x; gold (x) ∧ ¬ glitters (x)

(D) ∃x; glitters (x) ∧ ¬ gold (x)

Q2. Suppose you break a stick of unit length at a point chosen uniformly at random. Then the expected length of the shorter stick is _____ .

Q3. A machine has a 32-bit architecture, with 1-word long instructions. It has 64 registers, each of which is 32 bits long. It needs to support 45 instructions, which have an immediate operand in addition to two register operands. Assuming that the immediate operand is an unsigned integer, the maximum value of the immediate operand is _____.

Q4. Consider the code given below:

```
# include <stdio.h>
main
{
int i;
int * pi = &i;
```

```
scanf ("%d", pi) ;

pr intf ("%d \ n", i + 5) ;

}
```

Which one of the following statements is TRUE?

(A) Compilation fails.

(B) Execution results in a run-time error.

(C) On execution, the value printed is 5 more than the address of variable i.

(D) On execution, the value printed is 5 more than the integer value entered.

5. Let S and T be language over ={a,b} represented by the regular expressions (a+b*)* and (a+b)*, respectively. Which of the following is true?
(a) ScT (S is a subset of T)
(b) TcS (T is a subset of S)
(c) S=T
(d) SnT=Ø

6. Let L denotes the language generated by the grammar S – OSO/00. Which of the following is true?
(a) L = O
(b) L is regular but not O
(c) L is context free but not regular
(d) L is not context free

7. Which of the following statements in true?
(a) If a language is context free it can always be accepted by a deterministic push-down automaton
(b) The union of two context free languages is context free
(c) The intersection of two context free languages is context free
(d) The complement of a context free language is context free

8. What does the following function do for a given Linked List with first node as *head*?

```
void fun1(struct node* head)
{
 if(head == NULL)
```

```
  return;

 fun1(head->next);
 printf("%d  ", head->data);
}
```

A Prints all nodes of linked lists

B Prints all nodes of linked list in reverse order

C Prints alternate nodes of Linked List

D Prints alternate nodes in reverse order

9. Which of the following sorting algorithms can be used to sort a random linked list with minimum time complexity?

A Insertion Sort

B Quick Sort

C Heap Sort

D Merge Sort

10. What is the output of following function for start pointing to first node of following linked list? 1->2->3->4->5->6

```
void fun(struct node* start)
{
 if(start == NULL)
   return;
 printf("%d  ", start->data);

 if(start->next != NULL )
   fun(start->next->next);
 printf("%d  ", start->data);
}
```

A 1 4 6 6 4 1

B 1 3 5 1 3 5

C 1 2 3 5

D 1 3 5 5 3 1

11. In the worst case, the number of comparisons needed to search a singly linked list of length n for a given element is :

A log 2 n

B n/2

C log 2 n – 1

D n

12. Which of the following points is/are true about Linked List data structure when it is compared with array

A Arrays have better cache locality that can make them better in terms of performance.

B It is easy to insert and delete elements in Linked List

C Random access is not allowed in a typical implementation of Linked Lists

D The size of array has to be pre-decided, linked lists can change their size any time.

E All of the above

13. A hash table of length 10 uses open addressing with hash function h(k)=k mod 10, and linear probing.

After inserting 6 values into an empty hash table, the table is as shown below.

Which one of the following choices gives a possible order in which the key values could have been inserted in the table?

0	
1	
2	42
3	23
4	34
5	52
6	46
7	33
8	
9	

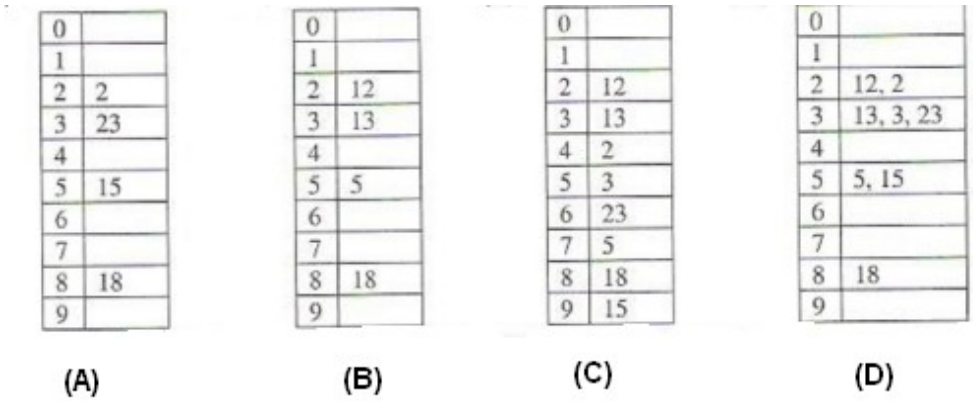
A 46, 42, 34, 52, 23, 33

B 34, 42, 23, 52, 33, 46

C 46, 34, 42, 23, 52, 33

D 42, 46, 33, 23, 34, 52

14. The keys 12, 18, 13, 2, 3, 23, 5 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function h(k) = k mod 10 and linear probing. What is the resultant hash table?



0	
1	
2	2
3	23
4	
5	15
6	
7	
8	18
9	

(A)

0	
1	
2	12
3	13
4	
5	5
6	
7	
8	18
9	

(B)

0	
1	
2	12
3	13
4	2
5	3
6	23
7	5
8	18
9	15

(C)

0	
1	
2	12, 2
3	13, 3, 23
4	
5	5, 15
6	
7	
8	18
9	

(D)

A A

B B

C C

D D

15. Consider a hash table of size seven, with starting index zero, and a hash function (3x + 4)mod7. Assuming the hash table is initially empty, which of the following is the contents of the table when the sequence 1, 3, 8, 10 is inserted into the table using closed hashing? Note that '_' denotes an empty location in the table.

A 8, _, _, _, _, _, 10

B 1, 8, 10, _, _, _, 3

C 1, _, _, _, _, _,3

D 1, 10, 8, _, _, _, 3

16. Which of the following statement(s) is TRUE?

1. A hash function takes a message of arbitrary length and generates a fixed length code.
2. A hash function takes a message of fixed length and generates a code of variable length.
3. A hash function may give the same hash value for distinct messages.

A I only

B II and III only

C I and III only

D II only

17. What is the maximum height of any AVL-tree with 7 nodes? Assume that the height of a tree with a single node is 0.

A 2

B 3

C 4

D 5

18. What is the worst case possible height of AVL tree?

A 2Logn
Assume base of log is 2

B 1.44log n
Assume base of log is 2

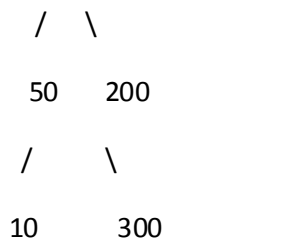
C Depends upon implementation

D Theta(n)

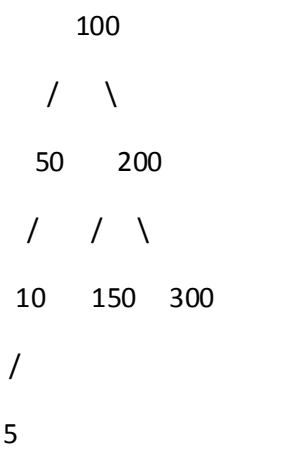
19. Which of the following is AVL Tree?

A

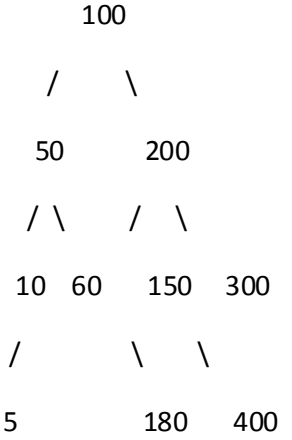
100



B



C



A Only A

B A and C

C A, B and C

D Only B

20. What is the worst case time complexity for search, insert and delete operations in a general Binary Search Tree?

A O(n) for all

B O(Logn) for all

C O(Logn) for search and insert, and O(n) for delete

D O(Logn) for search, and O(n) for insert and delete

21. Which of the following traversal outputs the data in sorted order in a BST?

A Preorder

B Inorder

C Postorder

D Level order

22. Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the in-order traversal sequence of the resultant tree?

A 7 5 1 0 3 2 4 6 8 9

B 0 2 4 3 1 6 5 9 8 7

C 0 1 2 3 4 5 6 7 8 9

D 9 8 6 4 2 3 0 1 5 7

23. The following numbers are inserted into an empty binary search tree in the given order: 10, 1, 3, 5, 15, 12, 16. What is the height of the binary search tree (the height is the maximum distance of a leaf node from the root)? (GATE CS 2004)

A 2

B 3

C 4

D 6

24. A circular linked list can be used for

A - Stack

B - Queue

C - Both Stack & Queue

D - Neither Stack or Queue

25. Which of the following algorithm is not stable?

A - Bubble Sort

B - Quick Sort

C - Merge Sort

D - Insertion Sort

26. Which of the following has search effeciency of O(1) –

A - Tree

B - Heap

C - Hash Table

D - Linked-List

27. Tower of hanoi is a classic example of

A - divide and conquer

B - recursive approach

C - B but not A

D - Both A & B

28. If we choose Prim's Algorithm for uniquely weighted spanning tree instead of Kruskal's Algorithm, then

A - we'll get a different spanning tree.

B - we'll get the same spanning tree.

C - spanning will have less edges.

D - spanning will not cover all vertices.

29. Which of these is the Worst-case time complexity of Quick Sort - and cannot be expressed in lower order terms ?

(a) O(n)
(b) O(n log n)
(c) $O(n^2)$
(d) $O(n^3)$
(e) O(log n)

30. Which of these is the worst case time complexity of Merge Sort - and cannot be expressed in lower order terms ?
(a) O(n)
(b) O(n log n)
(c) $O(n^2)$
(d) $O(n^3)$
(e) O(log n)

31. A heap is a particular kind of a binary search tree. This statement is:
(a) True
(b) False

32. The Floyd-Warshall all-pairs shortest path algorithm for finding the shortest distances between nodes in a graph is an example of:
(a) A Dynamic Programming formulation.
(b) A Greedy Algorithm
(c) A recursion based divide and conquer technique.

33. A bitwise operation 'f' has an interesting characteristic, such that, if f(a,b) = c, it always turns out to be the case that f(b,a) = c; f(a,c) = b; f(c,a) = b; f(b,c) = a; f(c,b) = a. Which of these functions could 'f' possibly be?
(*where a and b are the binary representations of any two non-negative integers*)

(a) f(a,b) = a XOR b
(b) f(a,b) = a + b
(c) f(a,b) = a - b
(d) f(a,b) = a * b

34. The graph algorithm which forms an essential component of the 'make' or 'ant build' used by programmers and software developers is:

(a) Flow maximization algorithm
(b) Shortest path algorithm
(c) Minimum spanning tree algorithm
(d) Bipartite matching
(e) Topological sort

35. Consider the following relational schema.

Students(rollno: integer, sname: string)
Courses(courseno: integer, cname: string)
Registration(rollno: integer, courseno: integer, percent: real)

Which of the following queries are equivalent to this query in English?

"Find the distinct names of all students who score more than 90% in the course numbered 107"

(I) SELECT DISTINCT S.sname
FROM Students as S, Registration as R
WHERE R.rollno=S.rollno AND R.courseno=107 AND R.percent >90

(II) $\prod_{sname}(\sigma_{courseno=107 \wedge percent>90}$ (Registration $\bowtie$ Students))

(III) $\{T \mid \exists S \in$ Students, $\exists R \in$ Registration (S.rollno=R.rollno $\wedge$

R.courseno=107 $\wedge$ R.percent>90 $\wedge$T.sname=S.sname)$\}$

(IV) $\{<S_N> \mid \exists S_R \exists R_P$ ($<S_R, S_N> \in$ Students $\wedge <S_R, 107, R_P> \in$ Registration $\wedge R_P>90)\}$

A I, II, III and IV

B I, II and III only

C I, II and IV only

D II, III and IV only

36. Given the basic ER and relational models, which of the following is INCORRECT?

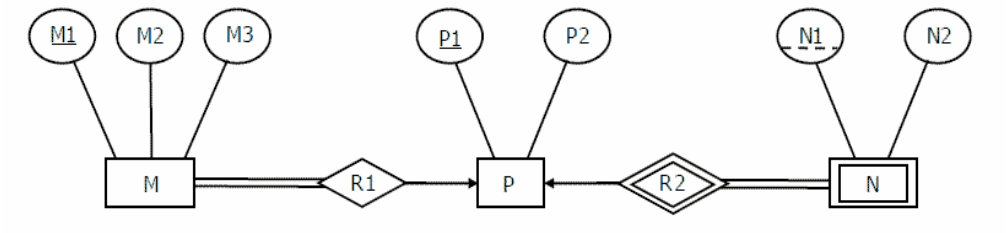
A An attribute of an entity can have more than one value

B An attribute of an entity can be composite

C In a row of a relational table, an attribute can have more than one value

D In a row of a relational table, an attribute can have exactly one value or a NULL value

37. Consider the following ER diagram.



The minimum number of tables needed to represent M, N, P, R1, R2 is

A 2

B 3

C 4

D 5

38. Information about a collection of students is given by the relation *studinfo(studId, name, sex)*. The relation *enroll(studId, courseId)* gives which student has enrolled for (or taken) that course(s). Assume that every course is taken by at least one male and at least one female student. What does the following relational algebra expression represent?

$$\Pi_{\text{courseId}}\left(\left(\Pi_{\text{studId}}\left(\sigma_{sex=\text{"female"}}\left(\text{studInfo}\right)\right)\times\Pi_{\text{courseId}}\left(\text{enroll}\right)\right)-\text{enroll}\right)$$

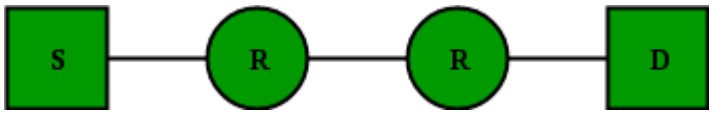
A Courses in which all the female students are enrolled.

B Courses in which a proper subset of female students are enrolled.

C Courses in which only male students are enrolled.

D None of the above

39. 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

40. One of the header fields in an IP datagram is the Time to Live(TTL)field.Which of the following statements best explains the need for this field?

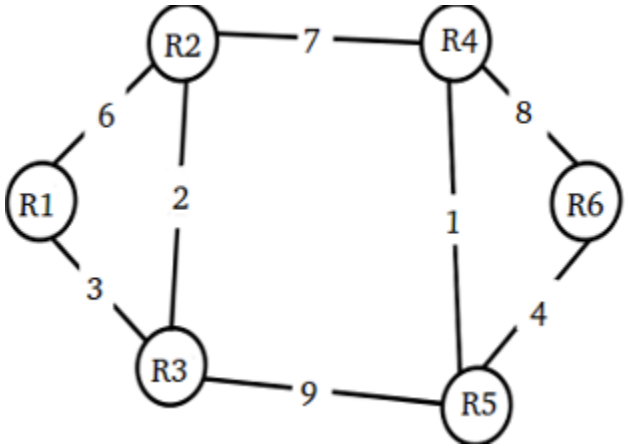
A It can be used to prioritize packets

B It can be used to reduce delays

C It can be used to optimize throughput

D It can be used to prevent packet looping

41. Consider a network with 6 routers R1 to R6 connected with links having weights as shown in the following diagram All the routers use the distance vector based routing algorithm to update their routing tables. Each router starts with its routing table initialized to contain an entry for each neighbour with the weight of the respective connecting link. After all the routing tables stabilize, how many links in the network will never be used for carrying any data?



A 4

B 3

C 2

D 1

42. Consider the following sequence of micro-operations.

MBR ← PC

MAR ← X

PC ← Y

Memory ← MBR

Which one of the following is a possible operation performed by this sequence?

A Instruction fetch

B Operand fetch

C Conditional branch

D Initiation of interrupt service

43. A RAM chip has a capacity of 1024 words of 8 bits each (1K × 8). The number of 2 × 4 decoders with enable line needed to construct a 16K × 16 RAM from 1K × 8 RAM is

A 4

B 5

C 6

D 7

44. 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

45. A computer has a 256 KByte, 4-way set associative, write back data cache with block size of 32 Bytes. The processor sends 32 bit addresses to the cache controller. Each cache tag directory entry contains, in addition to address tag, 2 valid bits, 1 modified bit and 1 replacement bit. The number of bits in the tag field of an address is

A 11

B 14

C 16

D 27