Paper No.

08

Written Test Paper, 2021

**SKILL INSTRUCTOR
(CSE / IT)**

Test Booklet No.

Name of Applicant ....

Answer Sheet No. ....

Application No. : SVSU/2020/Estt/NT/ ....

Signature of Applicant : ....

Date of Examination : **25 / 12 / 2021**

Signature of the Invigilator(s)

1. ....

Time of Examination : ....

2. ....

Duration : 60 Minutes]

[Maximum Marks : 50

IMPORTANT INSTRUCTIONS

(i) The question paper is in the form of Test-Booklet containing **50 (Fifty)** questions. All questions are compulsory. Each question carries four answers marked (A), (B), (C) and (D), out of which only one is correct.

(ii) On receipt of the Test-Booklet (Question Paper), the candidate should immediately check it and ensure that it contains all the pages, i.e., **50** questions. Discrepancy, if any, should be reported by the candidate to the invigilator immediately after receiving the Test-Booklet.

(iii) A separate Answer-Sheet is provided with the Test-Booklet/Question Paper. On this sheet there are **50** rows containing four circles each. One row pertains to one question.

(iv) The candidate should write his/her Application number at the places provided on the cover page of the Test-Booklet/Question Paper and on the Answer-Sheet and NOWHERE ELSE.

(v) No second Test-Booklet/Question Paper and Answer-Sheet will be given to a candidate. The candidates are advised to be careful in handling it and writing the answer on the Answer-Sheet.

(vi) For every correct answer of the question **One (1) mark will be awarded.** For every unattempted question, Zero (0) mark shall be awarded. **There is no Negative Marking.**

(vii) Marking shall be done only on the basis of answers responded on the Answer-Sheet.

(viii) To mark the answer on the Answer-Sheet, candidate should **darken** the appropriate circle in the row of each question with Blue or Black pen.

(ix) For each question only **one** circle should be **darkened** as a mark of the answer adopted by the candidate. If more than one circle for the question are found darkened or with one black circle any other circle carries any mark, the question will be treated as cancelled.

(x) The candidates should not remove any paper from the Test-Booklet/Question Paper. Attempting to remove any paper shall be liable to be punished for use of unfair means.

(xi) Rough work may be done on the blank space provided in the Test-Booklet/Question Paper only.

(xii) *Mobile phones (even in Switch-off mode) and such other communication/programmable devices are not allowed inside the examination hall.*

(xiii) No candidate shall be permitted to leave the examination hall before the expiry of the time.

DO NOT OPEN THIS QUESTION BOOKLET UNTIL ASKED TO DO SO.

1. Consider the number given by the decimal expression.

$$16^2*9 + 16^2*7 + 16*5 + 3$$

The no of 1's in the unsigned binary representation of the number is ....

(A) 16

(B) 9

(C) 21

(D) 32

2. Consider the equation $(123)_5 = (x8)_y$, with x and y as unknown. The number of possible solutions is _____

(A) 3

(B) 2

(C) 1

(D) 4

3. Let $f(A, B) = A' + B$. Simplified expression for function $f(f(x + y, y), z)$ is

(A) $x' + z$

(B) xyz

(C) $xy' + z$

(D) None of the above

4. Consider a multiplexer with X and Y as data inputs and Z as control input. Z = 0 selects input X, and Z = 1 selects input Y. What are the connections required to realize the 2-variable Boolean function f = T + R, without using any additional hardware?

(A) R to X, 1 to Y, T to Z

(B) T to X, R to Y, T to Z

(C) T to X, R to Y, 0 to Z

(D) R to X, 0 to Y, T to Z

5. A cache memory unit with capacity of N words and block size of B words is to be designed. If it is designed as a direct mapped cache, the length of the TAG field is 10 bits. If the cache unit is now designed as a 16-way set-associative cache, the length of the TAG field is _____ bits.

(A) 14

(B) 16

(C) 32

(D) 10

6. Consider a machine with a byte addressable main memory of 2^{32} bytes divided into blocks of size 32 bytes. Assume that a direct mapped cache having 512 cache line is used with this machine. The size of the tag filed in bites is _____.

(A) 32

(B) 16

(C) 18

(D) 12

3

7. Consider a non-pipelined processor with a clock rate of 2.5 gigahertz and average cycles per instruction of four. The same processor is upgraded to a pipelined processor with five stages; but due to the internal pipelined delay, the clock speed is reduced to 2 gigahertz. Assume that there are no stalls in the pipeline. The speed up achieved in this pipelined processor is _____.

(A) 3
(B) 2.5
(C) 3.2
(D) 4

8. If the associativity of a processor cache is doubled while keeping the capacity and block size unchanged, which one of the following is guaranteed to be NOT affected?

(A) Width of tag comparator
(B) Width of set index decoder
(C) Width of way selection multiplexor
(D) Width of processor to main memory data bus

9. 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

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

(A) 4
(B) 5
(C) 6
(D) 7

11. Consider the following C function.

void convert(int n){
if(n<0)
    printf("%d",n);
else {
    convert(n/2);
    printf("%d",n%2);
}
}

4

Which one of the following will happen when the function convert is called with any positive integer n as argument?

(A) It will print the binary representation of n and terminate

(B) It will print the binary representation of n in the reverse order and terminate

(C) It will print the binary representation of n but will not terminate

(D) It will not print anything and will not terminate

12. Consider the following C program:

```
#include <stdio.h>
int main(){
float sum = 0.0, j = 1.0, i = 2.0;
while (i/j > 0.0625){
j = j + j;
sum = sum + i/j;
printf("%f\n", sum);
}
return 0;
}
```

The number of times the variable sum will be printed, when the above program is executed, is _____.

(A) 4

(B) 3

(C) 5

(D) 6

13. Consider the following C code. Assume that unsigned long int type length is 64 bits.

```
unsigned long int fun(unsigned long int n){
    unsigned long int i, j = 0, sum = 0;
    for (i = n; i > 1; i = i/2) j++;
    for ( ; j > 1; j = j/2) sum++;
    return(sum);
}
```

The value returned when we call fun with the input 2^{40} is

(A) 4

(B) 5

(C) 6

(D) 40

14. 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;
}
```

5

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.

15. Which one of the following are essential features of object oriented language?

(a) Abstraction and encapsulation

(b) Strictly-typed

(c) Type-safe property coupled with sub-type rule

(d) Polymorphism in the presence of inheritance

(A) (a) and (b) only

(B) (a), (d) and (b) only

(C) (a) and (d) only

(D) (a), (c) and (d) only

16. In case of inheritance where both base and derived class are having constructors, when an object of derived class is created then _____ .

(A) constructor of derived class will be invoked first

(B) constructor of base class will be invoked first

(C) constructor of derived class will be executed first followed by base class

(D) constructor of base class will be executed first followed by derived class

17. In case of operator overloading, operator function must be _____ .

1. Static member functions

2. Non-static member functions

3. Friend Functions

(A) Only 2

(B) Only 1, 3

(C) Only 2, 3

(D) All 1, 2, 3

18. Find the wrong statement/s about Abstract Class

(A) We can't create its objects.

(B) We can't create pointers to an abstract class.

(C) It contains at least one pure virtual function.

(D) We can create references to an abstract class.

19. Which of the following is not a false statement about new operator?

(A) It can't be overloaded.

(B) It returns garbage value when memory allocation fails.

6

(C) It automatically computes the size of the data object.

(D) All of these

20. Find the output of following code:

```cpp
#include<iostream>
using namespace std;
class P {
public:
    void print()  { cout <<" Inside P"; }
};
class Q : public P {
public:
    void print() { cout <<" Inside Q"; }
};
class R: public Q { };
int main(void)
{
  R r;
  r.print();
  return 0;
}
```

(A) Inside P

(B) Inside Q

(C) Compiler Error: Ambiguous call to print()

(D) None of the above

21. The following C function takes a single-linked list of integers as a parameter and rearranges the elements of the list. The function is called with the list containing the integers 1, 2, 3, 4, 5, 6, 7 in the given order. What will be the contents of the list after the function completes execution?

```c
struct node {
int value;
struct node * next;
};
Void rearrange (struct node * list) {
struct node * p, * q;
int temp;
if (!list || !list -> next) return;
p = list; q = list -> next;
while (q) {
temp = p -> value; p -> value = q -> value;
q -> value = temp; p = q -> next
q = p? p -> next : 0;
}
}
```

(A) 1, 2, 3, 4, 5, 6, 7

(B) 2, 1, 4, 3, 6, 5, 7

(C) 1, 3, 2, 5, 4, 7, 6

(D) 2, 3, 4, 5, 6, 7, 1

22. Suppose a circular queue of capacity (n–1) elements is implemented with an array of n elements. Assume that the insertion and deletion operations are carried out using REAR and FRONT as array index variables, respectively. Initially, REAR = FRONT = 0. The conditions to detect queue full and queue empty are

(A) full: (REAR+1) mod n = = FRONT
  empty: REAR = = FRONT

(B) full: (REAR+1) mod n = = FRONT
  empty: (FRONT+1) mod n = = REAR

(C) full: REAR = = FRONT empty: (REAR+1) mod n = = FRONT

(D) full: (FRONT+1) mod n = = REAR
  empty: REAR = = FRONT

23. A queue is implemented using an array such that ENQUEUE and DEQUEUE operations are performed efficiently. Which one of the following statements is CORRECT (n refers to the number of items in the queue)?

(A) Both operations can be performed in O (1) time

(B) At most one operation can be performed in O (1) time but the worst case time for the other operation will be $\Omega(n)$

(C) The worst case time complexity for both operations will be $\Omega(n)$

(D) Worst case time complexity for both operations will be $\Omega(\log n)$

24. The pre-order traversal of a binary search tree is given by 12, 8, 6, 2, 7, 9, 10, 16, 15, 19, 17, 20. Then the post-order traversal of this tree is :

(A) 2, 6, 7, 8, 9, 10, 12, 15, 16, 17, 19, 20

(B) 2, 7, 6, 10, 9, 8, 15, 17, 20, 19, 16, 12

(C) 7, 2, 6, 8, 9, 10, 20, 17, 19, 15, 16, 12

(D) 7, 6, 2, 10, 9, 8, 15, 16, 17, 20, 19, 12

25. We have a binary heap on n elements and wish to insert n more elements (not necessarily one after another) into this heap. The total time required for this is

(A) $\Theta(\log n)$

(B) $\Theta(n)$

(C) $\Theta(n \log n)$

(D) $\Theta(n^2)$

26. The inorder and preorder traversal of a binary tree are

d b e a f c g and a b d e c f g, respectively.

The postorder traversal of the binary tree is:

(A) d e b f g c a

(B) e d b g f c a

(C) e d b f g c a

(D) d e f g b c a

27. What is the time complexity of the following recursive function:

```
int DoSomething (int n) {
    if (n <= 2)
        return 1;
    else
        return (DoSomething (floor(sqrt(n)))
        + n);
```

(A) $\Theta(n^2)$

(B) $\Theta(n \log_2 n)$

(C) $\Theta(\log_2 n)$

(D) $\Theta(\log_2 \log_2 n)$

28. Which of the following sorting algorithms has the lowest worst-case complexity?

(A) Merge Sort

(B) Selection Sort

(C) Quick Sort

(D) Bubble Sort

29. In a depth-first traversal of a graph G with n vertices,k edges are marked as tree edges. The number of connected components in G is

(A) k

(B) k+1

(C) n-k-1

(D) n-k

30. 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

31. What will be the output of the program?

```
public class A
{
    void A() /* Line 3 */
    {
        System.out.println("Class A");
    }
    public static void main(String[] args)
    {
        new A();
    }
}
```

(A) Class A

(B) Compilation fails.

(C) An exception is thrown at line 3.

(D) The code executes with no output.

32. Which statement is true?

(A) All objects that are eligible for garbage collection will be garbage collected by the garbage collector.

(B) Objects with at least one reference will never be garbage collected.

(C) Objects from a class with the finalize() method overridden will never be garbage collected.

(D) Objects instantiated within anonymous inner classes are placed in the garbage collectible heap.

33. Which statement is true?

(A) catch(X x) can catch subclasses of X where X is a subclass of Exception.

(B) The Error class is a RuntimeException.

(C) Any statement that can throw an Error must be enclosed in a try block.

(D) Any statement that can throw an Exception must be enclosed in a try block.

34. Which two can be used to create a new Thread?

1. Extend java.lang.Thread and override the run() method.

2. Extend java.lang.Runnable and override the start() method.

3. Implement java.lang.Thread and implement the run() method.

4. Implement java.lang.Runnable and implement the run() method.

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

35. Which class does not override the equals() and hashCode() methods, inheriting them directly from class Object?

(A) java.lang.String
(B) java.lang.Double
(C) java.lang.StringBuffer
(D) java.lang.Character

36. Assume that in a certain computer, the virtual addresses are 64 bits long and the physical addresses are 48 bits long. The memory is word addressable. The page size is 8 kB and the word size is 4 bytes. The Translation Look-aside Buffer (TLB) in the address translation path has 128 valid entries. At most how many distinct virtual addresses can be translated without any TLB miss?

(A) 16×2^{10}
(B) 256×2^{10}
(C) 4×2^{20}
(D) 8×2^{10}

37. In a file allocation system, which of the following allocation scheme(s) can be used if no external fragmentation is allowed?

I.   Contiguous

II. Linked

III. Indexed

(A) I and III only

(B) II only

(C) III only

(D) II and III only

38. Consider a computer system with 40-bit virtual addressing and page size of sixteen kilobytes. If the computer system has a one-level page table per process and each page table entry requires 48 bits, then the size of the per-process page table is _____ megabytes.

(A) 350

(B) 384

(C) 375

(D) 250

39. Consider a main memory with five page frames and the following sequence of page references: 3, 8, 2, 3, 9, 1, 6, 3, 8, 9, 3, 6, 2, 1, 3. Which one of the following is true with respect to page replacement policies First In First Out(FIFO) and Least Recently Used(LRU)?

(A) Both incur the same number of page faults.

(B) FIFO incurs 2 more page faults than LRU

(C) LRU incurs 2 more page faults than FIFO

(D) FIFO incurs 1 more page faults than LRU

40. Consider the following policies for preventing deadlock in a system with mutually exclusive resources.

I.   Processes should acquire all their resources at the beginning of execution. If any resource is not available, all resources acquired so far are released

II. The resources are numbered uniquely, and processes are allowed to request for resources only in increasing resource numbers

III. The resources are numbered uniquely, and processes are allowed to request for resources only in decreasing resource numbers

IV. The resources are numbered uniquely. A process is allowed to request only for a resource with resource number larger than its currently held resources

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Which of the above policies can be used for preventing deadlock?

(A) Any one of I and III but not II or IV

(B) Any one of I, III and IV but not II

(C) Any one of II and III but not I or IV

(D) Any one of I, II, III and IV

41. Consider an Entity-Relationship (ER) model in which entity sets E1 and E2 are connected by an m : n relationship R12. E1 and E3 are connected by a 1 : n (1 on the side of E1 and n on the side of E3) relationship R13.

E1 has two single-valued attributes a11 and a12 of which a11 is the key attribute. E2 has two single-valued attributes a21 and a22 of which a21 is the key attribute. E3 has two single-valued attributes a31 and a32 of which a31 is the key attribute. The relationships do not have any attributes.

If a relational model is derived from the above ER model, then the minimum number of relations that would be generated if all the relations are in 3NF is _____.

(A) 3

(B) 4

(C) 5

(D) 6

42. Given the following schema:

employees(emp-id, first-name, last-name, hire-date, dept-id, salary)

departments(dept-id, dept-name, manager-id, location-id)

You want to display the last names and hire dates of all latest hires in their respective departments in the location ID 1700. You issue the following query:

SQL> SELECT last-name, hire-date

FROM employees WHERE (dept-id, hire-date) IN

(SELECT dept-id, MAX(hire-date)

FROM employees JOIN departments USING(dept-id)

WHERE location-id = 1700

GROUP BY dept-id);

What is the outcome?

(A) It executes but doesn't give the correct result

(B) It executes and gives the correct result

(C) It generates an error because of pairwise comparison

(D) It generates an error because the GROUP BY clause cannot be used with table joins in a sub query

43. Consider a B+ tree in which the search key is 12 bytes long, block size is 1024 bytes, record pointer is 10 bytes long and block pointer is 8 bytes long. The maximum number of keys that can be accommodated in each non-leaf node of the tree is ____.

(A) 35

(B) 50

(C) 55

(D) 40

44. Consider the following two statements about database transaction schedules:

I. Strict two-phase locking protocol generates conflict serializable schedules that are also recoverable.

II. Timestamp-ordering concurrency control protocol with Thomas Write Rule can generate view serializable schedules that are not conflict serializable.

Which of the above statement/s is/are TRUE?

(A) Both I and II

(B) I Only

(C) II Only

(D) Neither I nor II

45. Match the following:

List - I	List - II
(P) SMTP	(1) Application layer
(Q) BGP	(2) Transport layer
(R) TCP	(3) Data link layer
(S) PPP	(4) Network layer
	(5) Physical layer

(A) P-2, Q-1, R-3, S-5

(B) P-1, Q-4, R-2, S-3

(C) P-1, Q-4, R-2, S-5

(D) P-2, Q-4, R-1, S-3

46. An IP datagram of size 1000 bytes arrives at a router. The router has to forward this packet on a link whose MTU (maximum transmission unit) is 100 bytes. Assume that the size of the IP header is 20 bytes.

The number of fragments that the IP datagram will be divided into for transmission is _____.

(A) 13

(B) 16

(C) 32

(D) 64

47. In the network 200.20.11.144/27, the fourth octet (in decimal) of the last IP address of the network which can be assigned to a host is _____.
(A) 152
(B) 158
(C) 224
(D) 255

48. Consider that 15 machines need to be connected in a LAN using 8-port Ethernet switches. Assume that these switches do not have any separate uplink ports. The minimum number of switches needed is _____.
(A) 5
(B) 8
(C) 3
(D) 6

49. A network has a data transmission bandwidth of 20×10^6 bits per second. It uses CSMA/CD in the MAC layer. The maximum signal propagation time from one node to another node is 40 microseconds. The minimum size of a frame in the network is _____ bytes.
(A) 200
(B) 400
(C) 150
(D) 500

50. For the IEEE 802.11 MAC protocol for wireless communication, which of the following statement/s is/are TRUE?
I. At least three non-overlapping channels are available for transmissions.
II. The RTS-CTS mechanism is used for collision detection.
III. Unicast frames are ACKed.
(A) All I, II and III
(B) I and III only
(C) II and III only
(D) II only

14

ROUGH WORK

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ANSWER KEY Skill Instructor CSE IT

1. B	26. A
2. A	27. D
3. C	28. A
4. A	29. D
5. A	30. B
6. C	31. D
7. C	32. D
8. D	33. A
9. D	34. C
10. B	35. C
11. D	36. B
12. C	37. D
13. B	38. B
14. D	39. A
15. C	40. D
16. D	41. B
17. C	42. B
18. B	43. B
19. C	44. A
20. B	45. B
21. B	46. A
22. A	47. B
23. A	48. C
24. B	49. A
25. A	50. B