	INDIAN SPACE RESEARCH ORGANISATION	SET A
	COMPUTER SCIENCE	

- Which of the following is true?

(a) $\sqrt{3} + \sqrt{7} = \sqrt{10}$	(b) $\sqrt{3} + \sqrt{7} \leq \sqrt{10}$
(c) $\sqrt{3} + \sqrt{7} < \sqrt{10}$	(d) $\sqrt{3} + \sqrt{7} > \sqrt{10}$

- What is the sum to infinity of the series,
 $3 + 6x^2 + 9x^4 + 12x^6 + \dots$ given $|x| < 1$?

(a) $\frac{3}{(1+x^2)}$	(b) $\frac{3}{(1+x^2)^2}$
(c) $\frac{3}{(1-x^2)^2}$	(d) $\frac{3}{(1-x^2)}$

- $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x}$ is given by

(a) 0	(b) -1
(c) 1	(d) $\frac{1}{2}$

- If (G, \cdot) is a group such that $(ab)^{-1} = a^{-1}b^{-1}$, $\forall a, b \in G$, then G is a/an

(a) Commutative semi group	(b) Abelian group
(c) Non-abelian group	(d) None of these

- A given connected graph G is a Euler Graph if and only if all vertices of G are of

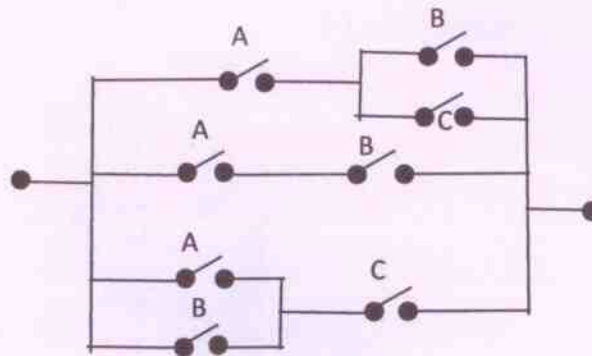
(a) Same degree	(b) Even degree
(c) Odd degree	(d) Different degree

- Maximum number of edges in a n - node undirected graph without self-loops is

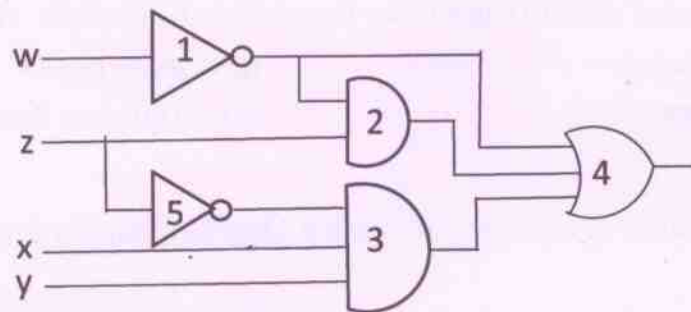
(a) n^2	(b) $\frac{n(n-1)}{2}$
(c) $n-1$	(d) $\frac{n(n+1)}{2}$



7. The minimum number of NAND gates required to implement the Boolean function $A + A\bar{B} + A\bar{B}C$ is equal to
- (a) 0 (Zero) (b) 1
(c) 4 (d) 7
8. The minimum Boolean expression for the following circuit is



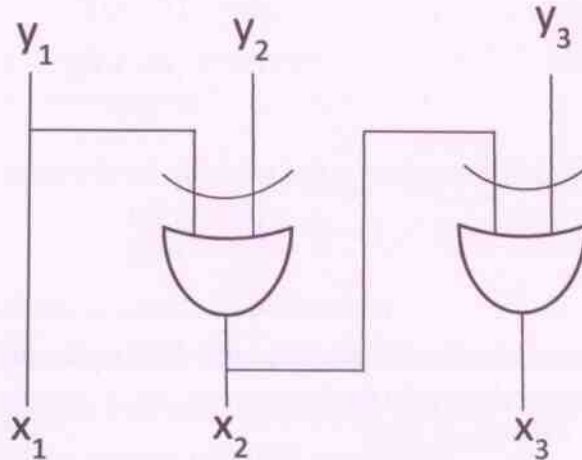
- (a) $AB + AC + BC$ (b) $A + BC$
(c) $A + B$ (d) $A + B + C$
9. For a binary half-subtractor having two inputs A and B , the correct set of logical expression for the outputs D ($= A$ minus B) and X ($=$ borrow) are
- (a) $D = AB + \bar{A}\bar{B}$, $X = \bar{A}B$ (b) $D = \bar{A}B + A\bar{B}$, $X = A\bar{B}$
(c) $D = \bar{A}B + A\bar{B}$, $X = \bar{A}\bar{B}$ (d) $D = AB + \bar{A}\bar{B}$, $X = A\bar{B}$
10. Consider the following gate network



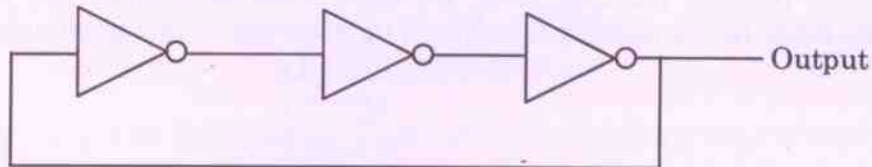
Which one of the following gates is redundant?

- (a) Gate No. 1 (b) Gate No. 2
(c) Gate No. 3 (d) Gate No. 4

11. The dynamic hazard problem occurs in
- (a) Combinational circuit alone (b) Sequential Circuit only
- (c) Both (a) and (b) (d) None of the above
12. The logic circuit given below converts a binary code y_1, y_2, y_3 into



- (a) Excess-3 code (b) Gray code
- (c) BCD code (d) Hamming Code
13. The circuit shown in the figure below is



- (a) An oscillating circuit and its output is square wave
- (b) The one whose output remains stable in '1' state
- (c) The one having output remains stable in '0' state
- (d) Has a single pulse of three times propagation delay
14. If $12A7C_{16} = X_8$, then the value of X is
- (a) 224174 (b) 425174
- (c) 6173 (d) 225174

15. The Excess-3 Code is also called
 (a) Cyclic Redundancy Code (b) Weighted Code
 (c) Self-Complementing Code (d) Algebraic Code
16. The simplified Sum of Product form of the following Boolean expression
 $(P + \bar{Q} + \bar{R})(P + Q + R)(P + Q + \bar{R})$
 (a) $(\bar{P}Q + R)$ (b) $(P + Q\bar{R})$
 (c) $(P\bar{Q} + R)$ (d) $(PQ + R)$
17. Which of the following binary number is the same as its 2's complement?
 (a) 1010 (b) 0101
 (c) 1000 (d) 1001
18. The functional difference between SR flip-flop and JK flip-flop is that
 (a) JK flip-flop is faster than SR flip-flop
 (b) JK flip-flop has a feedback path
 (c) JK flip-flop accepts both inputs 1
 (d) None of the above
19. Consider a non-pipelined processor with a clock rate of 2.5 GHz and average cycles per instruction of four. The same processor is upgraded to a pipelined processor with five stages; but due to the internal pipeline delay, the clock speed is reduced to 2 GHz. Assume that there are no stalls in the pipeline. The speed up achieved in this pipelined processor is
 (a) 3.2 (b) 3.0
 (c) 2.2 (d) 2.0
20. What is the output of this C code?

```
#include <stdio.h>
void main()
{
  int k = 5;
  int *p = &k;
  int **m = &p;
  printf("%d %d %d\n", k, *p, **m);
}
```

 (a) 5 5 5 (b) 5 5 junk
 (c) 5 junk junk (d) Compile time error



21. Consider a disk pack with 16 surfaces, 128 tracks per surface and 256 sectors per track. 512 bytes of data are stored in a bit serial fashion in a sector. The capacity of the disk pack and the number of bits required to specify a particular sector in the disk respectively
- (a) 256 MB, 19 bits (b) 256 MB, 28 bits
(c) 512 MB, 20 bits (d) 64 GB, 28 bits
22. Let the page fault service time be 10 ms in a computer with average memory access time being 20 ns. If one page fault is generated for every 10^6 memory accesses, what is the effective access time for the memory?
- (a) 21.4 ns (b) 29.9 ns
(c) 23.5 ns (d) 35.1 ns
23. 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 eliminate certain kind of hazards
(d) As part of address translations
24. In which class of Flynn's taxonomy, Von Neumann architecture belongs to?
- (a) SISD (b) SIMD
(c) MIMD (d) MISD
25. What will be output of following program? Assume that you are running this program in little-endian processor.
- ```
#include<stdio.h>
int main() {
short a = 320;
char *ptr;
 ptr = (char *)&a;
 printf("%d",*ptr);
return 0;
}
```
- (a) 1 (b) 320  
(c) 64 (d) Compilation Error



26. Consider the following segment of C code

```
int j, n;
j = 1;
while (j <= n)
 j = j*2;
```

The number of comparisons made in the execution of the loop for any  $n > 0$  is

- (a)  $\lfloor \log_2 n \rfloor * n$  (b)  $n$   
(c)  $\lfloor \log_2 n \rfloor$  (d)  $\lfloor \log_2 n \rfloor + 1$

27. The following postfix expression with single digit operands is evaluated using a stack

8 2 3 ^ / 2 3 \* + 5 1 \* -

(Note that ^ is the exponential operator)

The top two elements of the stack after the first \* operator is evaluated are

- (a) 6, 1 (b) 5, 7  
(c) 3, 2 (d) 1, 5

28. Average number of comparison required for a successful search for sequential search on 'n' items is

- (a)  $\frac{n}{2}$  (b)  $\frac{(n-1)}{2}$   
(c)  $\frac{(n+1)}{2}$  (d) None of the above

29. A Hash Function  $f$  is defined as  $f(\text{key}) = \text{key} \bmod 7$ . With linear probing, while inserting the keys 37, 38, 72, 48, 98, 11, 56 into a table indexed from 0, in which location the key 11 will be stored (count table Index 0 as 0<sup>th</sup> location)?

- (a) 3 (b) 4  
(c) 5 (d) 6



30. A complete binary tree with  $n$  non-leaf nodes contains
- (a)  $\log_2 n$  nodes (b)  $n + 1$  nodes  
(c)  $2n$  nodes (d)  $2n + 1$  nodes
31. Algorithm design technique used in quick sort algorithm is
- (a) Dynamic programming (b) Backtracking  
(c) Divide and Conquer (d) Greedy Method
32. An FSM (Finite State Machine) can be considered to be a Turing Machine of finite tape length
- (a) Without rewinding capability and unidirectional tape movement  
(b) Rewinding capability and unidirectional tape movement  
(c) Without rewinding capability and bidirectional tape movement  
(d) Rewinding capability and bidirectional tape movement
33. Let  $L = \{w \in (0+1)^* \mid w \text{ has even number of 1s}\}$ , i.e.  $L$  is the set of all bit strings with even number of 1s. Which one of the regular expression below represents  $L$ ?
- (a)  $(0^*10^*1)^*$  (b)  $0^*(10^*10^*)^*$   
(c)  $0^*(10^*1^*)^*0^*$  (d)  $0^*1(10^*1)^*10^*$
34. Consider the following recurrence
- $$T(n) = 2T(\sqrt{n}) + 1$$
- $$T(1) = 1$$
- Which of the following is true?
- (a)  $T(n) = O(\log \log n)$  (b)  $T(n) = O(\log n)$   
(c)  $T(n) = O(\sqrt{n})$  (d)  $T(n) = O(n)$



35. Consider the following statements about the context-free grammar :

$$G = \{S \rightarrow SS, S \rightarrow ab, S \rightarrow ba, S \rightarrow \wedge\}$$

- I. G is ambiguous  
II. G produces all strings with equal number of a's and b's  
III. G can be accepted by a deterministic PDA

Which combinations below expresses all the true statements about G?

- (a) I only (b) I and III only  
(c) II and III only (d) I, II and III
36. If  $L$  and  $\bar{L}$  are recursively enumerable, then  $L$  is
- (a) Regular (b) Context-free  
(c) Context-sensitive (d) Recursive

37.  $S \rightarrow aSa \mid bSb \mid a \mid b$

The language generated by the above grammar over the alphabets  $\{a, b\}$  is the set of

- (a) All palindromes  
(b) All odd length palindromes  
(c) Strings that begin and end with same symbol  
(d) All even length palindromes
38. What is the highest type number that can be assigned to this following grammar :

$$S \rightarrow Aa, A \rightarrow Ba, B \rightarrow abc$$

- (a) Type 0 (b) Type 1  
(c) Type 2 (d) Type 3
39. Access time of the symbol table will be logarithmic, if it is implemented by
- (a) Linear list (b) Search Tree  
(c) Hash Table (d) Self-organization list





40. Recursive descent parsing is an example of
- (a) Top-down parsers (b) Bottom-up parsers  
(c) Predictive parsers (d) None of these
41. A top-down parser generates
- (a) Rightmost derivation (b) Rightmost derivation in reverse  
(c) Leftmost derivation (d) Leftmost derivation in reverse
42. Relative mode of addressing is most relevant to writing
- (a) Co-routines (b) Position-independent code  
(c) Sharable code (d) Interrupt Handlers
43. A simple two-pass assembler does which of the following in the first pass?
- (a) Checks to see if the instructions are legal in the current assembly mode  
(b) It allocates space for the literals  
(c) It builds the symbol table for the symbols and their values  
(d) All of these
44. Peephole optimization is a form of
- (a) Loop optimization (b) Local optimization  
(c) Constant folding (d) Data flow analysis
45. At a particular time of computation, the value of a counting semaphore is 7. Then 20 P operation and  $x$  V operations were completed on this semaphore. If the final value of the semaphore is 5,  $x$  will be
- (a) 18 (b) 22  
(c) 15 (d) 13
46. With single resource, deadlock occurs
- (a) If there are more than two processor competing for that resource  
(b) If there are only two processes competing for that resource  
(c) If there is a single process competing for that resource  
(d) None of these



47. A system has 3 processes sharing 4 resources. If each process needs a maximum of 2 units, then
- (a) Deadlock can never occur  
(b) Deadlock may occur  
(c) Deadlock has to occur  
(d) None of these
48. Determine the number of page faults when references to pages occur in the following order : 1, 2, 4, 5, 2, 1, 2, 4. Assume that the main memory can accommodate 3 pages and the main memory already has the pages 1 and 2, with page one having brought earlier than page 2. (LRU page replacement algorithm is used)
- (a) 3  
(b) 5  
(c) 4  
(d) None of these
49. Working Set  $(t, k)$  at an instant of time  $t$  is
- (a) The set of  $k$  future references that the Operating System (OS) will make  
(b) The set of future references that the OS will make in next  $t$  unit of time  
(c) The set of  $k$  references with high frequency  
(d) The  $k$  set of pages that have been referenced in the last  $t$  time units
50. A CPU generates 32-bit virtual addresses. The page size is 4 KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 128 page table entries and is 4-way set associative. The minimum size of the TLB tag is
- (a) 11 bits  
(b) 13 bits  
(c) 15 bits  
(d) 20 bits
51. The real-time operating system, which of the following is the most suitable scheduling scheme?
- (a) Round robin  
(b) First come first serve  
(c) Pre-emptive  
(d) Random scheduling




52. In which one of the following page replacement policies, Balady's anomaly may occur?
- (a) FIFO (b) Optimal  
(c) LRU (d) MRU
53. Consider Join of a relation  $R$  with a relation  $S$ . If  $R$  has  $m$  tuples and  $S$  has  $n$  tuples, then maximum and minimum sizes of the Join respectively are
- (a)  $m + n$  and 0  
(b)  $mn$  and 0  
(c)  $m + n$  and  $|m - n|$   
(d)  $mn$  and  $m + n$
54. Let  $R(a, b, c)$  and  $S(d, e, f)$  be two relations in which  $d$  is the foreign key of  $S$  that refers to the primary key of  $R$

Consider the following four operations in  $R$  and  $S$

- I. Insert into  $R$   
II. Insert into  $S$   
III. Deletion from  $R$   
IV. Deletion from  $S$

Which of the following can cause violation of the relational integrity constraint above?

- (a) Both I and IV  
(b) Both II and III  
(c) All of these  
(d) None of these

|                                                                                   |                                    |                  |
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55. The relation **book** (title, price) contains the titles and prices of different books. Assuming that no two books have the same price, what does the following SQL query list?

[select title from book as B where (select count(\*) from book as T where T.price > B.price) < 5]

- (a) Titles of the four most expensive books
- (b) Title of the fifth most inexpensive book
- (c) Title of the fifth most expensive book
- (d) Titles of the five most expensive books

56. Goals for the design of the logical schema include

- (a) Avoiding data inconsistency
- (b) Being able to construct queries easily
- (c) Being able to access data efficiently
- (d) All of these

57. Given the relations

*employee* (*name, salary, deptno*) and

*department* (*deptno, deptname, address*)

Which of the following queries cannot be expressed using the basic relational algebra operations ( $U, -, \times, \pi, \sigma, \rho$ )?

- (a) Department address of every employee
- (b) Employees whose name is the same as their department name
- (c) The sum of all employees' salaries
- (d) All employees of a given department

