Code No.	J – 2288

Entrance Examination for Admission to the M.Tech. Degree Courses in the Teaching Departments, 2020

CSS

COMPUTER SCIENCE

General Instructions

1. The Question Paper is having two Parts — Part 'A' Objective type (60%) & Part 'B' Descriptive type (40%).
2. Objective type questions which carry 1 mark each are to be (✓) 'tick marked' in the response sheets against the appropriate answers provided.
3. 8 questions are to be answered out of 12 questions carrying 5 marks each in Part 'B'.
4. **Negative marking** : 0.25 marks will be deducted for each wrong answer in Part 'A'.

Time : 2 Hours **Max. Marks : 100**

To be filled in by the Candidate									
Register Number	in Figures								
	in words								

PART – A

(Objective Type)

Choose appropriate answer from the options in the questions. **One** mark **each**.

(60 × 1 = 60 marks)

1. How many number of 8 : 1 MUX is required to implement 256 : 1 MUX?

   a) 32 b) 33

   c) 36 d) 37

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2. Which of the following statement is **incorrect** for the range of *n* bits binary numbers?
   a) Range of signed 1's complement numbers is -2^{n-1} to 2^{n-1}
   b) Range of signed 2's complement numbers is -2^{n-1} to 2^{n-1} to $2^{n-1}-1$
   c) Range of unsigned numbers is 0 to $2^{n}-1$
   d) Range of signed is $-2^{n-1}+1$ to $2^{n+1}-1$

3. The number of duals of distinct Boolean expression of 3 variable is
   a) 8 b) 16
   c) 32 d) None of these

4. Which one of the following is the correct sequence of numbers represented in the series $(12)_3$, $(13)_4$, $(14)_5$, $(15)_6$?

a) 4, 6, 8, 10
b) 5, 7, 9, 11
c) 4, 6, 9, 11
d) 5, 7, 8, 10

5. Consider the Boolean function $f(A, B, C, D) = \sum m(0, 1, 2, 5, 7, 8, 10, 12, 14, 15)$. How many essential prime implicants are there in the above function?

a) 3
b) 4
c) 2
d) None of these

6. A MOD-8 gray up-counter is constructed using T-flip-flops only. If the initial state of the counter is $S_0 = 010$, then the minimum number of clock cycles required to reach a state of (100) will be

a) 2
b) 3
c) 4
d) 5

7. A situation where several processes access and manipulate same data concurrently and the outcome of the execution depends on the particular order in which the access takes place is called

a) Mutual exclusion
b) Process synchronization
c) Convey effect
d) Race condition

8. Consider the following statements with respect to user-level threads and kernel level threads :

S_1 : Kernel-level threads can be scheduled independently.

S_2 : For user-level threads, a system call can block the entire process.

S_3 : Context switching in kernel level threads is faster than user level thread.

Which of the above statements are true?

a) **S_1** only
b) **S_2** only
c) **S_1** and **S_2** only
d) **S_2** and **S_3** only

9. Consider a system having '22' resources of the same type. These resources are shared by 4 processes P, Q, R and S which have peak demands of 3, 6, 'X', 'Y' respectively. What is the maximum value of X $\times$ Y to ensure that there will be no deadlock?

a) 64
b) 128
c) 32
d) None of these

10. Consider the following statement is FALSE with respect to CPU scheduling policy?

a) Medium term scheduler, selects one of the process from job queue and allocates CPU to one of them
b) Round Robin policy is most suitable for a time shared operating system
c) Shortest remaining time first policy may cause starvation
d) Context switch times are highly dependent on hardware support

11. Consider 6 memory partitions of each of sizes 300 KB, 500 KB, 800 KB, 400 KB, 450 KB, 700 KB where KB refers to kilobyte. These partitions need to be allocated to four processes of size 250 KB, 510 KB, 75 KB, 750 KB in that order.

Consider the following statements with respect to the above scenario.

S_1 : If first fit policy is used, no process will remain unallocated.

S_2 : If best fit policy is used, no process will remain unallocated.

Which of the above statements is/are correct?

a) Only **S_1** is true
b) Only **S_2** is true
c) Both **S_1** and **S_2** is true
d) Neither of **S_1** or **S_2** is true

12. A CPU generates 64 bit virtual address. Page size is of 16 KB. The processor has a translation-look a side-Buffer (TLB) which can hold a total of 128 page table entries and is a 4-way set associative. The minimum size of TLB tag is ———————— bits.

a) 44
b) 47
c) 50
d) None of these

13. Consider the following statement s :

S_1 : Static allocation binding do not change at runtime.

S_2 : Heap allocation allocates and de-allocates memory at run time.

Which of the following is true?

a) Only **S_1**
b) Only **S_2**
c) Both **S_1** and **S_2**
d) Neither of **S_1** nor **S_2**

14. Consider the CFG with {S, P, Q, R} as the non-terminal alphabet, {*a*, *b*} as the terminal alphabet, *S* as the start symbol and the following set of production rules :

$S \rightarrow bS \mid aP \mid b$

$P \rightarrow bP \mid aQ$

$Q \rightarrow bQ \mid aS \mid a$

Which of the following strings is generated by the grammar?

a) babaab
b) aababa
c) abaaab
d) None of these

15. Which of the following is TRUE?

a) LR(k) is the most general backtracking shift-reduce parsing method

b) LALR parser is most powerful and costly as compare to other parses

c) Every SLR grammar is umambiguous but not every unambiguous grammar is SLR

d) All CFG's are LR and all LR grammar are unambiguous

16. Consider the following CFG, with S as the start symbol :

$S \rightarrow x\,A \mid CB \mid$

$A \rightarrow B\,x\,A \mid \varepsilon$

$B \rightarrow yB \mid A\,y \mid \varepsilon$

$C \rightarrow B$

Which of the following is correct?

a) First(S) = {x, y, ε}

First(B) = {y, ε}

Follow(C) = {y, x, $}

b) First(S) = {x, ε}

First(B) = {y, ε}

Follow(C) = {x, y, ε}

c) First(S) = {x, y, $}

First(B) = {y, ε}

Follow(C) = {x, y, $}

d) First(S) = {x, y, ε}

First(B) = {x, ε}

Follow(C) = {x, y, $}

17. Consider the following statements :

S_1 : To evaluate postfix expression, one operator stack is used.

S_2 : The sequence of procedure cells corresponds to a post-order traversal of activation tree

S_3 : The sequence of returns corresponds to a pre-order traversal of the activation tree.

Which of the following is true?

a) Only **S_1**
b) Only **S_2**
c) Only **S_2** and **S_3**
d) **S_1** , **S_2** and **S_3**

18. Which of the following is true?

a) Symbol table is constructed during the analysis part of compiler i.e. (front end)
b) Type checking is done during syntax analysis phase
c) SDD with only synthesised attribute always has an order of evaluation
d) Both (a) and (c)

19. Which of the following sorting technique has the maximum Best-case time Complexity?

a) Insertion sort
b) Selection sort
c) Quick sort
d) Merge sort

20. Consider the already built heap (Max heap) :

34, 30, 26, 18, 22, 20, 25, 16, 3

Which of the following is the correct level-order traversal obtained after 2 deletions?

a) 26, 22, 18, 3, 25, 20, 16
b) 26, 22, 25, 18, 3, 20, 16
c) 18, 3, 22, 20, 16, 25, 26
d) None of these

21. Consider an unsorted array with n distinct elements with a property that every element can be atmost k distance from its original position.

What is the worst case time complexity to get the sorted array?

a) $O(\log n)$ b) $O(n)$

c) $O(n^2)$ d) $O(n \log k)$

22. Consider the sorted sequences J, K, L, M, N having lengths 36, 24, 52, 78 and 16 respectively. They have to be merged into a single sequence by merging together two sequences at a time. The maximum number of comparisons that will be needed by the optimal merge sort algorithm for merging all lengths is

a) 226 b) 230

c) 446 d) 450

23. Consider a weighted complete graph on vertex set $\{V_1, V_2, \cdots, V_n\}$ such that the weight of the edge (V_i, V_j) is $4|i-j|$, the weight of a minimum spanning tree using prim's algorithm is

a) $n-1$ b) $4n-4$

c) $4n$ d) $4n-1$

24. An n-array tree in which every node has 0 or n children. If number of internal nodes is 20 and leaf nodes is 261, then the value of 'n' is

a) 11 b) 12

c) 13 d) 14

25. Which of the following protocol is used to monitor network devices such as hubs, switches and routers?

a) SNMP b) RIP

c) SMTP d) OSPF

26. For a class C network if IP address of a computer is 201.89.52.112 and subnet mask is 255.255.255.224 the decimal value of last octet of last host of sixth subnet is

a) 220 b) 222

c) 240 d) 242

27. If 2, –4 are the Eigen values of a non-singular matrix A and $|A| = -8$, then the Eigen values of $\text{Adj}(A)$ are x and $-y$ then the value of $x + y$ is

a) –4 b) 4

c) –6 d) 6

28. Let $g(x) = x^3 + x^2 + 1$. Consider the information bits (1, 1, 0, 1, 1, 0). Find the code word corresponding to these information bits, if $g(x)$ is used as the generating polynomial.

a) 110110111 b) 110011111

c) 101110101 d) 110111101

29. Consider the following statements :

S_1 : Time-to-live (TTL) field in IPv4 datagram is used to reduce delay

S_2 : Both Ethernet frame and IPv4 packet include checksum fields

S_3 : In IPv6, when a datagram needs to be discarded in a congested network, the decision is based on the hop limit field in the base header.

Which of the above statement(s) are correct?

a) Only **S_1** and **S_2**

b) Only **S_1** and **S_3**

c) Only **S_2** and **S_3**

d) None of these

30. Consider the following services in network security :

I. Authentication of message

II. Integrity

III. Privacy

IV. Non repudiation

Which of the security services is/are NOT provided by digital signature?

a) Only **I** and **II**
b) Only **IV**
c) Only **III**
d) Only **III** and **IV**

31. Consider the following statement with respect to the application layer :

S_1 : Datagram is the PDU (Protocol Data Unit) used

S_2 : There is a fixed limit on the maximum size of data that it can pass on the TCP layer

Which of the following option is correct?

a) Only **S_1** is true
b) Only **S_2** is true
c) Both **S_1** and **S_2** is true
d) Neither **S_1** or **S_2** is true

32. Consider the following statements :

S_1 : Manchester and differential Manchester encoding has a transition at the middle of each bit

S_2 : Nyquist theorem specifies the minimum sampling rate to the twice the bandwidth of the signal

S_3 : The signal rate is sometimes called the bit rate.

S_4 : In synchronous transmission, we send 1 start bit at the beginning and 1 or more stop bits at the end of each byte.

Which of the above are TRUE?

a) Only **S_1** and **S_2**
b) Only **S_2** and **S_4**
c) Only **S_3** and **S_4**
d) Only **S_2, S_3** and **S_4**

33. Which one of the following statement, best characterize a computer that use memory mapped I/O?

a) The computer provides special instruction for manipulating I/O port

b) I/O ports are placed at address on bus and are accessed just like other memory location

c) To perform an I/O operation, it is sufficient to place the data in an address and call the channel to perform the operation

d) Ports are referenced only by memory mapped instruction of the computer and are located at hardwired memory location

34. Consider a 4-way set associative. Cache (initially empty) with total 16 cache blocks. The main memory consist of 512 blocks and the request for memory blocks in the order which is given as : 4, 35, 25, 45, 51, 49, 5, 12, 11, 26, 25, 35, 51, 49, 11, 37, 39, 41, 25, 7, 35.

What is the number of misses in the cache when least recently policy and least frequently policy is used respectively?

a) 12, 13 b) 12, 14

c) 14, 13 d) 13, 14

35. Which of the following is true?

a) Immediate addressing mode is used to initialize variable

b) Index addressing mode is faster than direct addressing mode

c) Relative addressing suits for locality of reference

d) Both (a) and (c)

36. A 4-way set associative cache memory consists of 128 blocks. The main memory consists of 16384 memory block and each block contains 256 eight bit words. Find how many bits are needed to represent TAG, SET and WORD field respectively?

a) 5, 9, 8 b) 9, 5, 8

c) 8, 9, 5 d) 8, 5, 9

37. In a vectored interrupt :

a) the interrupting device supplies the branch information to the processor through an interrupt vector

b) the CPU does not know, which device cause the interrupt without polling each I/O interface

c) the branch address is always assigned to a fixed location in memory

d) None of the above

38. Consider 4-way set associative cache of a 64 KB organized into a 32 blocks. Main memory size is 4 GB. In the cache controller, each line in the set contains 1 valid, 1 modified and 4 replacement bits along with a tag. How much space is required in the cache controller to store the tag information (Meta data)?

a) 36 KB b) 38 KB

c) 48 KB d) 46 KB

39. Two cards are drawn together from a pack of 52 cards. The probability that one is spade and other is king, is

a) 1/26 b) 2/51

c) 8/221 d) None of these

40. Consider a table having tuple (A, C) with attributes A and C, where A is the Primary Key and C is the foreign referencing A with on-delete cascade. Tuples of the table are (9, 5) (4, 5) (5, 4) (2, 9) (8, 9) (10, 2) (7, 5). The number of elements in the set of tuples that must be additional deleted to preserve referential integrity when the tuple (9, 5) is deleted

a) 1 b) 2

c) 3 d) 4

41. Consider the following schedule :

S : r_1 (X), r_2 (X), r_1 (Y), r_2 (X), $commit_1$, w_3 (X), $commit_2$, r_3 (X), $commit_3$

Which of the following is true?

a) Schedule is not view serializable schedule but recoverable schedule

b) Schedule is not conflict serializable but strict recoverable schedule

c) Schedule is conflict serializable but strict recoverable schedule

d) Schedule is conflict sterializable but not strict recoverable schedule

42. Consider the following relational schema R (A, B, C)

A	B	C
15	16	17
14	15	16
19	16	17
18	13	9

The number of records resulted by the below SQL query is

Select * from R where C = ALL(select B from R where A > 20)

a) 1 b) 2

c) 3 d) 4

43. A is 2×3 real matrix and $AX = B$ is an inconsistent system of equations. The highest possible rank of A is

a) 1 b) 2

c) 3 d) None of these

44. Consider the two sets of FD's for the relation R (A, B, C, D, E)

$F_1 = \{A \rightarrow B, AB \rightarrow C, D \rightarrow AC , D \rightarrow E\}$

$F_2 = \{A \rightarrow BC, D \rightarrow AE\}$

Which of the following statement true about FD set?

a) $F_1 \subset F_2$ b) $F_1 \supset F_2$

c) $F1 \equiv F2$ d) None of these

45. Consider the function $y = x^2 - 6x + 9$. The maximum value of y is obtained when x varies over the interval 2 to 5 will be at the point x =

a) 2 b) 3

c) 4 d) 5

46. Consider the following Relational Schema R(A, B, C, D, E, F) and functional dependency set :

{AB $\rightarrow$ C, C $\rightarrow$ A, BC $\rightarrow$ D, ACD $\rightarrow$ B, BE $\rightarrow$ C, EC $\rightarrow$ AF, CF $\rightarrow$ BD, D $\rightarrow$ E}

What is the highest normal form satisfied by relation R?

a) 1NF b) 2NF

c) 3NF d) BCNF

47. A binary search tree when traversed in pre-order and the values in each node printed out, the sequence of values obtained is 20, 16, 9, 7, 8, 38, 22, 21, 27, 26, 40, 45. If the tree is traversed in post-order, the sequence obtained would be

a) 9, 7, 8, 16, 45, 40, 38, 26, 27, 21, 22, 20

b) 8, 7, 9, 16, 21, 26, 27, 22, 45, 40, 38, 20

c) 7, 8, 9, 16, 21, 22, 26, 27, 40, 45, 38, 20

d) None of these

48. What does the following C-statement declare?

Float *(*f[n]) (char *a);

a) f is a 'n' elements array of pointers to functions, each function takes an argument as pointer to a character and return a pointer to a float

b) f is a 'n' elements array of pointers to functions, each function takes an argument as a character and return a pointer to a float

c) f is a 'n' elements array of pointers to functions, each function takes an argument as a character and return a float

d) None of these

49. Consider the following recursive C program:

```
void fun (int n)
{
    if(n < 1) return;
    fun (n – 2);
    fun (n – 3);
}
main( )
{  int i=5;
    fun (i);
}
```

The number of times 'fun' function will be invoked before returning control back to main ( ) is

a) 5 b) 7

c) 8 d) 9

50. Which of the following permutations can be obtained in the output (in the same order) using a stack assuming that the input is the sequence 8, 10, 11, 7, 9 in that order?

a) 9, 11, 7, 10, 8 b) 9, 7, 8, 10, 11

c) 9, 7, 10, 11, 8 d) 10, 11, 7, 9, 8

51. The minimum number of nodes present in AVL tree of height 'h' = 6 are ———— (Assume for a single node height = 0).

a) 20 b) 28

c) 33 d) 36

52. The result of evaluation of the profit expression

6 2 3 + – 3 8 2 / + * 2 ^ 3 +

(All the operands in the above expression are single digit operands)

a) 46 b) 48

c) 52 d) None of these

53. Let $L_1 = \{a^n b^m \mid n \le m\}$ and $L_2 = \{a^n b^m \mid n > m\}$ be two context free language. Which of the following is correct?

a) $L_1 \cup L_2 = \{a^n b^n \mid n \ge 0\}$

b) $L_1 \cup (L_2)^c = \{a^n b^m \mid n \le m\}$

c) $L_1 \cup L_2 = (a^* b^*)$

d) $L_1 \cup L_2 = (a + b)^*$

54. Which one of the following languages over the alphabet {a, b} is described by the regular expression:

(a(ba)*(a + bb) + b(ab)*(b + aa))(a + b)*

a) Set of strings that contains either 'aa' or 'bb' as the substring

b) Set of strings that begin and end with a or b

c) Set of string that contain atmost one time two consecutive a's or two consecutive b's

d) None of the above

55. The number of steps of any string (w) of length 'n', if grammar is in CNF form and GNF form respectively?

a) 2n and n

b) 2n – 1 and n

c) $\log_2 n$ and n – 1

d) n – 1 and $\log_2 n$

56. Consider the following set of regular expressions :

I. (a* + b* + c)*

II. (a* b* c*)*

III. ((ab)* + c*)*

IV. (a* b* + c*)*

Which of the above regular expressions are equivalent?

a) **I** and **II** only

b) **II** and **III** only

c) **I, II** and **III** only

d) **I, II** and **IV** only

57. Which of the following statement about regular languages is not true?

a) There is a Regular language which is subset of every language and which needs only 1 state in its minimal deterministic finite automata

b) There is a Regular language which is superset of every language and which needs only 1 state in its minimal deterministic finite automata

c) The union of two non-regular languages can be regular

d) Every subset of regular language is regular

58. What is the length of the shortest string not in the language over alphabet $\sum = \{0, 1\}$ of the following regular expression?

(0 + 10)*1*

a) 2 b) 3

c) 4 d) None of these

59. Which of the following is/are valid :

I. $((p \Rightarrow q) \wedge (r \Rightarrow s)\ (p \vee r)) \Rightarrow (q \vee s)$

II. $((p \Rightarrow q) \wedge (r \Rightarrow s)\ (\sim q \vee \sim s)) \Rightarrow (\sim p \vee \sim r)$

III. $((p \Rightarrow q) \wedge (q \Rightarrow r)) \Rightarrow (p \Rightarrow r)$

a) I and II only b) I and III only

c) II and III only d) I, II and III

60. At a point $x = 1$, the function

$f(X) = \begin{cases} x^3 - 1, & 1 < x < \infty \\ x - 1, & -\infty < x \leq 1 \end{cases}$ is

a) continuous and not differentiable

b) continuous and differentiable

c) discontinuous and differentiable

d) discontinuous and not differentiable

ANSWER SHEET — PART – A

1	A	B	C	D	E	21	A	B	C	D	E	41	A	B	C	D	E
2	A	B	C	D	E	22	A	B	C	D	E	42	A	B	C	D	E
3	A	B	C	D	E	23	A	B	C	D	E	43	A	B	C	D	E
4	A	B	C	D	E	24	A	B	C	D	E	44	A	B	C	D	E
5	A	B	C	D	E	25	A	B	C	D	E	45	A	B	C	D	E
6	A	B	C	D	E	26	A	B	C	D	E	46	A	B	C	D	E
7	A	B	C	D	E	27	A	B	C	D	E	47	A	B	C	D	E
8	A	B	C	D	E	28	A	B	C	D	E	48	A	B	C	D	E
9	A	B	C	D	E	29	A	B	C	D	E	49	A	B	C	D	E
10	A	B	C	D	E	30	A	B	C	D	E	50	A	B	C	D	E
11	A	B	C	D	E	31	A	B	C	D	E	51	A	B	C	D	E
12	A	B	C	D	E	32	A	B	C	D	E	52	A	B	C	D	E
13	A	B	C	D	E	33	A	B	C	D	E	53	A	B	C	D	E
14	A	B	C	D	E	34	A	B	C	D	E	54	A	B	C	D	E
15	A	B	C	D	E	35	A	B	C	D	E	55	A	B	C	D	E
16	A	B	C	D	E	36	A	B	C	D	E	56	A	B	C	D	E
17	A	B	C	D	E	37	A	B	C	D	E	57	A	B	C	D	E
18	A	B	C	D	E	38	A	B	C	D	E	58	A	B	C	D	E
19	A	B	C	D	E	39	A	B	C	D	E	59	A	B	C	D	E
20	A	B	C	D	E	40	A	B	C	D	E	60	A	B	C	D	E

COMPUTER SCIENCE

PART – B

(Descriptive Type)

Answer **any eight** questions. **(8 × 5 = 40 Marks)**

1. Explain the different types of memory mapping scheme used in cache?

2. Explain the conversion of ER diagram to Relational Schema?

3. (a) Define deadlock

   (b) Explain the necessary conditions for deadlock.

4. Describe the phases of compiler design with the help of block diagram.

5. (a) Explain synchronous and asynchronous counter with example.

   (b) Design a MOD 6 synchronous UP-COUNTER using JK Master Slave flip flp.

6. Explain the types of grammar as per Noam Chomsky classification with examples.

7. Compare distance vector routing and link state routing.

8. (a) Write Strassen's matrix multiplication algorithm.

   (b) Write its recurrence relation and time complexity.

9. Explain the different types of tree traversal algorithm with examples?

10. (a) Define tautology. Give one example.

    (b) Prove that ~(~p) ≡ p

11. (a) Define linear transformation.

    (b) State dimension theorem for linear transformation.

12. What are the different types of CPU scheduling algorithms? Explain each one in detail.

———————