DO NOT OPEN THE SEAL UNTIL INSTRUCTED TO DO SO

Question Booklet No.

QUESTION BOOKLET

COMPUTER ENGINEERING

Booklet Series

A

Roll No. | | | | | |

(Enter your Roll number in the above space)

Time Allowed : 2 Hours **Maximum Marks : 100**

INSTRUCTIONS FOR CANDIDATES

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS QUESTION BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR QUESTIONS ETC. IF SO, GET IT REPLACED BY A COMPLETE QUESTION BOOKLET.
2. Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Question Booklet Series Code A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the OMR Answer Sheet liable for rejection.
3. This Question Booklet contains **100** questions. Each question is printed in **English** only. Each question comprises four responses (answers). You will select the response which you want to mark on the OMR Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each question.
4. You have to mark all your responses **ONLY** on the separate OMR Answer Sheet provided. See Instructions at the backside of the OMR Answer Sheet.
5. **All** questions carry equal marks.
6. Before you proceed to mark in the OMR Answer Sheet the response to various questions in the Question Booklet, you have to fill in some particulars in the OMR Answer Sheet as per instructions mentioned on the OMR Answer Sheet.
7. After you have completed filling in all your responses on the OMR Answer Sheet and the examination has concluded, you should hand over to the Invigilator **only the OMR Answer Sheet**. You are permitted to take away with you the **Question Booklet**, along with candidate's copy of **OMR Answer Sheet**.
8. Sheets for rough work are appended in the Question Booklet at the end.
9. **Penalty for wrong answers :**

   THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE AS UNDER.

   (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **0.25 mark** assigned to that question will be deducted as penalty.

   (ii) If a candidate gives more than one answer, it will be treated as a wrong answer even if one of the given answers happens to be correct and there will be same penalty as above to that question.

   (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be no penalty for that question.

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1. The binary equivalent of $(1011{\cdot}011)_{10}$ is equal to

[A] 11·375

[B] 10·123

[C] 11·175

[D] 9·234

2. The following switching functions are to be implemented using a decoder :

$f_1 = \Sigma m\ (1, 2, 4, 8, 10, 14)$, $f_2 = \Sigma m\ (2, 5, 9, 11)$, $f_3 = \Sigma m\ (2, 4, 5, 6, 7)$.

The minimum configuration of the decoder will be

[A] 2 to 4 line

[B] 3 to 8 line

[C] 4 to 16 line

[D] 5 to 32 line

3. The parallel outputs of a counter circuit represent the

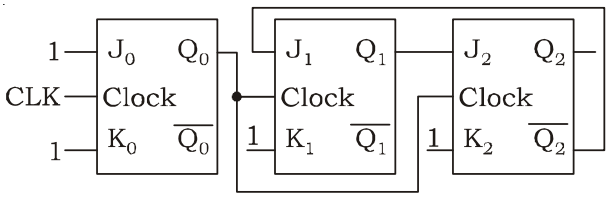
[A] parallel data word

[B] clock frequency

[C] counter modulus

[D] clock count

4. The figure shows a digital circuit constructed using negative edge triggered J-K flip flops. Assume a starting state of Q2Q1Q0=000. This state Q2Q1Q0=000 will repeat after _____ number of cycles of the clock CLK.



[A] 4

[B] 8

[C] 16

[D] 6

5. In a k-way set associative cache, the cache is divided into v sets, each of which consists of k lines. The lines of a set are placed in sequence one after another. The lines in set s are sequenced before the lines in set (s+1). The main memory blocks are numbered from 0 onwards. The main memory block numbered j must be mapped to any one of the cache lines from

[A] (j mod v)* k to (j mod v) * k+(k–1)

[B] (j mod v) to (j mod v) + (k–1)

[C] (j mod k) to (j mod k) + (v–1)

[D] (j mod k) * v to (j mod k) * v + (v–1)

6. The main virtue for using single Bus structure is

[A] fast data transfers

[B] cost effective connectivity and speed

[C] cost effective connectivity and ease of attaching peripheral devices

[D] cheaper in price

7. Consider three different processors P1, P2, P3 executing the same instruction set. P1 has a 3 GHz clock rate and a CPI of 1·5. P2 has a 2·5 GHz clock rate and a CPI of 1·0. P3 has a 4 GHz clock rate and a CPI of 2·2. If each processor executes a program in 10 seconds, find the number of instructions executed by the processors.

[A] 18*10^3, 13*10^2, 17*10^5

[B] 20*10^9, 25*10^9, 18·18*10^9

[C] 18*10^4, 25*10^1, 20*10^3

[D] 3*10^1, 15*10^2, 2·5*10^3

8. A 50 kbps device is connected to a processor. The interrupt overhead is 50 μsec. The minimum performance achieved when interrupt is initiated and data transferred is used instead of programmed I/O is

[A] 2·4
[B] 0·4
[C] 3
[D] 3·5

9. What will be the output printed by the following C program?

```
void main()
{
    int x=1, i, y=2;
    for (i=0; i<5; i++)
    {
        x<<1;
        y=x+i;
    }
    printf("%d, %d", x,y);
}
```

[A] 1, 5
[B] 32, 5
[C] 1, 72
[D] 32, 72

10. 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

11. The post-order traversal of a binary tree is 8, 9, 6, 7, 4, 5, 2, 3, 1. The in-order traversal of the same tree is 8, 6, 9, 4, 7, 2, 5, 1, 3. The height of a tree is the length of the longest path from the root to any leaf. The height of the binary tree above is

[A] 3
[B] 5
[C] 4
[D] 2

12. N items are stored in a sorted doubly linked list. For a delete operation, a pointer is provided to the record to be deleted. For a decrease-key operation, a pointer is provided to the record on which the operation is to be performed. An algorithm performs the following operations on the list in this order: Θ(N)delete, O(logN)insert, O(logN)find and Θ(N)decrease-key. What is the time complexity of all these operations put together?

[A] $O(\log^2 N)$
[B] O(N)
[C] $O(N^2)$
[D] $\Theta(N^2 \log N)$

13. What is the maximum number of edges in a bipartite graph having 10 vertices?

[A] 24
[B] 21
[C] 25
[D] 16

14. If the array A contains the items 10, 4, 7, 23, 67, 12 and 5 in that order, what will be the resultant array A after third pass of insertion sort?

[A] 67, 12, 10, 5, 4, 7, 23
[B] 4, 7, 10, 23, 67, 12, 5
[C] 4, 5, 7, 67, 10, 12, 23
[D] 10, 7, 4, 67, 23, 12, 5

15. Which one of the following hash functions on integers will distribute keys most uniformly over 10 buckets numbered 0 to 9 for i ranging from 0 to 2020?

[A] $h(i)=i^2 \bmod 10$

[B] $h(i)=i^3 \bmod 10$

[C] $h(i)=(11*i^2) \bmod 10$

[D] $h(i)=(12*i) \bmod 10$

16. What happens when a top-down approach of dynamic programming is applied to any problem?

[A] It increases both the time complexity and the space complexity

[B] It increases the space complexity and decreases the time complexity

[C] It increases the time complexity and decreases the space complexity

[D] It decreases both the time complexity and the space complexity

17. Let G be a complete undirected graph on 4 vertices, having 6 edges with weights being 1, 2, 3, 4, 5 and 6. The maximum possible weight that a minimum weight spanning tree of G can have is

[A] 5

[B] 8

[C] 7

[D] 20

18. The Floyd-Warshall algorithm for all-pair shortest paths computation is based on

[A] Greedy paradigm

[B] Divide-and-Conquer paradigm

[C] Dynamic Programming paradigm

[D] Heuristics

19. An array of 25 distinct elements is to be sorted using quicksort. Assume that the pivot element is chosen uniformly at random. The probability that the pivot element gets placed in the worst possible location in the first round of partitioning (rounded off to 2 decimal places) is

[A] 0·5

[B] 0·7

[C] 0·9

[D] 0·08

20. Which of the following CFG's cannot be simulated by an FSM?

[A] $S \rightarrow Sa \mid b$

[B] $S \rightarrow aSb \mid ab$

[C] $S \rightarrow abX,\ X \rightarrow cY,\ Y \rightarrow d \mid aX$

[D] $S \rightarrow Sb \mid a$

21. What is the pumping length of string of length x?

[A] x+1

[B] x

[C] x–1

[D] x^2

22. Consider the languages L1= ϕ and L2={a}. Which of the following represents L1 $L2^*$ U $L1^*$?

[A] $\{\sigma\}$

[B] $\{\varepsilon\phi\}$

[C] $\{\pi\}$

[D] $\{\varepsilon\}$

23. 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

24. Which one of the following is a top-down parser?

[A] Recursive descent parser

[B] Operator precedence parser

[C] An LR(k) parser

[D] An LALR(k) parser

25. Whenever a procedure is executed, its activation record is stored on the stack, also known as

[A] Access Stack

[B] Control Stack

[C] Formal Stack

[D] Return Stack

26. Consider the following translation scheme :

$S \rightarrow ER$

$R \rightarrow *E\{print(\text{“*”});\}R \mid \varepsilon$

$E \rightarrow F+E\{print(\text{“+”});\} \mid F$

$F \rightarrow (S) \mid id\{print(id.value);\}$

Here id is a token that represents an integer and id.value represents the corresponding integer value. For an input '2 * 3 + 4', this translation scheme prints

[A] 2 * 3 + 4

[B] 2 * + 3 4

[C] 2 3 * 4 +

[D] 2 3 4 + *

27. What is the maximum number of reduce moves that can be taken by a bottom-up parser for a grammar with no epsilon-production and unit-production (i.e., of type $A \rightarrow \varepsilon$ and $A \rightarrow a$) to parse a string with n tokens?

[A] n/2

[B] n-1

[C] 2n-1

[D] 2^n

28. How are system calls invoked?

[A] By a privileged instruction

[B] With an indirect jump

[C] Through a software interrupt

[D] Through polling

29. The time required to create a new thread in an existing process is

[A] greater than the time required to create a new process

[B] less than the time required to create a new process

[C] equal to the time required to create a new process

[D] double the time required to create a new process

30. Consider the following snapshot of a system running n concurrent processes. Process i is holding X_i instances of a resource R, $1 \le i \le n$. Assume that all instances of R are currently in use. Further, for all i, process i can place a request for at most Y_i additional instances of R while holding the X_i instances it already has. Of the n processes, there are exactly two processes p and q such that $Y_p = Y_q = 0$. Which one of the following conditions guarantees that no other process apart from p and q can complete execution?

[A] $X_p + X_q < Min\{Y_k \mid 1 \le k \le n, k \ne p, k \ne q\}$

[B] $X_p + X_q < Max\{Y_k \mid 1 \le k \le n, k \ne p, k \ne q\}$

[C] $Min(X_p, X_q) \ge Min\{Y_k \mid 1 \le k \le n, k \ne p, k \ne q\}$

[D] $Min(X_p, X_q) \le Max\{Y_k \mid 1 \le k \le n, k \ne p, k \ne q\}$

31. Consider three concurrent processes P1, P2 and P3 as shown below, which access a shared variable D that has been initialized to 100 :
P1::D=D+20 P2::D=D+50 P3::D=D+10
The processes are executed on a uniprocessor system running a time-shared operating system. If the minimum and maximum possible values of D after the three processes have completed execution are X and Y respectively, then the value of Y–X is

[A] 110
[B] 20
[C] 80
[D] 10

32. If we preempt a resource from a process, the process cannot continue with its normal execution and it must be

[A] aborted
[B] rolled back
[C] terminated
[D] queued

33. Consider the following four processes with arrival times (in milliseconds) and their lengths of CPU bursts (in milliseconds) as shown below :

Process	P1	P2	P3	P4
Arrival time	0	1	3	4
CPU burst time	3	1	3	Z

These processes are run on a single processor using preemptive Shortest Remaining Time First scheduling algorithm. If the average waiting time of the processes is 1 millisecond, then the value of Z is

[A] 3
[B] 2
[C] 5
[D] 7

34. An ER model of a database consists of entity types A and B. These are connected by a relationship R which does not have its own attribute. Under which one of the following conditions can the relational table for R be merged with that of A?

[A] Relationship R is one-to-many and the participation of A in R is total

[B] Relationship R is one-to-many and the participation of A in R is partial

[C] Relationship R is many-to-one and the participation of A in R is total

[D] Relationship R is many-to-one and the participation of A in R is partial

35. Consider a database table T containing two columns X and Y each of type integer. After the creation of the table, one record (X=1, Y=1) is inserted in the table. Let MX and MY denote the respective maximum values of X and Y among all records in the table at any point in time. Using MX and MY, new records are inserted in the table 128 times with X and Y values being MX+1, 2*MY+1 respectively. It may be noted that each time after the insertion, values of MX and MY change. What will be the output of the following SQL query after the steps mentioned above are carried out?

SELECT Y FROM T WHERE X=7

[A] 127

[B] 255

[C] 129

[D] 257

36. The employee information in a company is stored in the relation

Employee (name, sex, salary, deptName)

Consider the following SQL query

select deptName

from Employee

where sex = 'M'

group by deptName

having avg (salary) > (select avg (salary) from Employee)

It returns the names of the department in which

[A] the average salary is more than the average salary in the company

[B] the average salary of male employees is more than the average salary of all male employees in the company

[C] the average salary of male employees is more than the average salary of employees in the same department

[D] the average salary of male employees is more than the average salary in the company

37. How many 8-bit characters can be transmitted per second over a 9600 baud serial communication link using asynchronous mode of transmission with one start bit, eight data bits, two stop bits and one parity bit?

[A] 600

[B] 800

[C] 876

[D] 120

38. A link has a transmission speed of 10^6 bits/sec. It uses data packets of size 1000 bytes each. Assume that the acknowledgement has negligible transmission delay and that its propagation delay is the same as the data propagation delay. Also assume that the processing delays at the nodes are negligible. The efficiency of the stop-and-wait protocol in this setup is exactly 25%. The value of the one-way propagation delay (in milliseconds) is

[A] 10

[B] 24

[C] 12

[D] 05

39. Determine the maximum length of the cable (in km) for transmitting data at a rate of 500 Mbps in an Ethernet LAN with frames of size 10000 bits. Assume the signal speed in the cable to be 200000 km/s.

[A] 1

[B] 2

[C] 2·5

[D] 5

40. Consider a source computer(S) transmitting a file of size 10^6 bits to a destination computer(D)over a network of two routers (R_1 and R_2) and three links (L_1, L_2 and L_3). L_1connects S to R_1; L_2 connects R_1 to R_2; and L_3 connects R_2 to D. Let each link be of length 100 km. Assume signals travel over each link at a speed of 10^8 meters per second. Assume that the link bandwidth on each link is 1 Mbps. Let the file be broken down into 1000 packets each of size 1000 bits. Find the total sum of transmission and propagation delays in transmitting the file from S to D.

[A] 1005 ms

[B] 1010 ms

[C] 3000 ms

[D] 3003 ms

41. Consider an IP packet with a length of 4500 bytes that includes a 20-byte IPv4 header and a 40-byte TCP header. The packet is forwarded to an IPv4 router that supports a Maximum Transmission Unit (MTU) of 600 bytes. Assume that the length of the IP header in all the outgoing fragments of this packet is 20 bytes. Assume that the fragmentation offset value stored in the first fragment is 0.
The fragmentation offset value stored in the third fragment is
[A] 144
[B] 255
[C] 102
[D] 124

42. In the IPv4 addressing format, the number of networks allowed under Class C addresses is
[A] 2^14
[B] 2^7
[C] 2^21
[D] 2^24

43. Let $Z = [a_{ij}]$ which is given by $ab_{ij} = (i-j)^3$. Z is denoted by
[A] symmetric matrix
[B] anti-symmetric matrix
[C] identity matrix
[D] None of the above

44. What is the mean value (mv) in a Poisson Distribution, such that 't' is the number of trials and 's' is the probability of success?
[A] mv = ts
[B] mv = $(ts)^2$
[C] mv = ts(1–s)
[D] mv = s

45. Which among the following logic gates are known as universal gates?
[A] XOR, NAND, OR
[B] OR, NOT, XOR
[C] NOR, NAND, XNOR
[D] NOR, NAND

46. The SIMD is an organization which
[A] contains a lot of processing units under the common control unit supervision
[B] is capable of processing many programs at one time
[C] contains an individual computer having control unit, processing unit and a memory unit
[D] All of the above

47. The rotational latency required in reading a block of data from a disk to memory along with seek time and transfer time is
[A] the total time required for the platter to rotate the right sector under the head
[B] the total time required for read and write head to move in the correct position over the appropriate track
[C] the total time required for the platter to complete its full rotation
[D] None of the above

48. Which among the following bits is used when the cache location is updated?
[A] Flag bit
[B] Reference bit
[C] Update bit
[D] Dirty bit

49. When a subroutine is called, the address of the instruction following the CALL instructions is stored in/on the
[A] Stack
[B] Accumulator
[C] Program Counter (PC)
[D] Stack pointer

50. For a given priority queue, what is the time complexity to insert a node based on some position?
[A] O(nlogn)
[B] O(logn)
[C] $O(n^2)$
[D] O(n)

51. Convert the infix expression to postfix expression

"a+(b*c(d/e^f)*g)*h)"

[A] ab*cdef/^*g-h+

[B] abcdef^/*g*h*+

[C] abcd*^ed/g*-h*+

[D] abc*de^fg/*-*h+

52. Dijkstra's algorithm follows

[A] Greedy algorithm

[B] Branch and bound

[C] Back tracking

[D] Dynamic programming

53. Given an alphabet Σ, a regular language is a language which is not obtained from the basic languages by using which of the following operations?

[A] Union

[B] Concatenation

[C] Kleene*

[D] All of the above

54. Lang1 = {x|x does not contain the string 'pg'}

Lang2 = {x|x contains the string 'pg'}

Given Σ = {p, g}, what is the difference of the minimum number of states that is required to form Lang1 and Lang2?

[A] 0

[B] 1

[C] 2

[D] Not determined

55. Given an expression L(G)={w in T*|S→*w}, find out the total number of incorrect notations or symbols, such that changing them would make the expression correct.

[A] 0 Error

[B] 1 Error

[C] 2 Errors

[D] Invalid Expression

56. What is the total number of states that are required to automate the given expression i.e. {a,b}*{aba}{a,b}* using finite automata?

[A] 4

[B] 3

[C] 5

[D] 6

57. Find the non-context free language among the following.

[A] L = {ωωR|ω∈{0,1}*}

[B] L = {p^nq^n|n≥0}

[C] L = {ωω|ω∈{0,1}*}

[D] L = {p^nq^mr^ms^n|n, m≥0}

58. The Bottom-up parsing method is also called

[A] Predictive parsing

[B] Shift reduce parsing

[C] Recursive descent parsing

[D] None of the above

59. Which FSA concept is used in the compiler?

[A] Code optimization

[B] Code generation

[C] Lexical analysis

[D] Parser

60. Find out the most powerful parsers.

[A] SLR

[B] LALR

[C] Canonical LR

[D] Operator-precedence

61. Given a string of tokens; which of the following is the method of finding a parse?

[A] Analysing

[B] Recognizing

[C] Parsing

[D] Tokenizing

62. Which among the following is used to group the characters into tokens?

[A] Parser

[B] Code generator

[C] Lexical analyser

[D] None of the above

63. In the translation process, compiler always reports the existence of which of the following?

[A] Objects

[B] Classes

[C] Errors

[D] Text

64. What is the exact location of operating system in the memory?

[A] Either low or high memory (depending on the location of interrupt vector)

[B] In the low memory

[C] In the high memory

[D] None of the above

65. The technique of copying a process from main memory to secondary memory based on requirement is called

[A] Demand paging

[B] Paging

[C] Threads

[D] Segmentation

66. Find out the reference to the associative memory.

[A] The data address is generated by the CPU

[B] The data address of the data is supplied by the users

[C] The data itself is used as an address and there is no need for an address

[D] The data are accessed sequentially

67. Select one statement which contains error.

[A] select* from stock where stockid = 10008

[B] select stockid from stock where stockid = 10003

[C] select stockid from stock

[D] select stockid where stockid = 10005 and Lastname = 'johnson'

68. Choose the correct expression from the following for maximum children of a B-tree having order m.

[A] m/2

[B] m –1

[C] m

[D] m+1

69. It is stated that every time an attribute X is appeared, the same value of Y is matched and a different value of Z is matched. Thus, it is clear that

[A] $X \rightarrow Y$

[B] $X \rightarrow Z$

[C] $X \rightarrow (Y,Z)$

[D] $(Y,Z) \rightarrow X$

70. Which of the following is the characteristic of distributed database?

[A] It is a single logical database which is limited to only one location

[B] It is a loose collection of file which is limited to only one location

[C] It is a loose collection of file that is spread to multiple locations and is interconnected by a network

[D] A single logical database that is spread to multiple locations and is interconnected by a network

71. Identify the device from the following options that usually links two homogeneous packed broadcast local networks.

[A] A Hub

[B] A Router

[C] A Bridge

[D] A Gateway

72. Find the transmission rate of circuit of the TDM where a link transmits 4000 frames per second and each slot has 8 bits respectively. TDM is

[A] 32 kbps

[B] 500 bps

[C] 500kbps

[D] 32 bps

73. There is a point where secure internal network and untrusted external network meet and a firewall is installed at this point. This is known as

[A] Chokepoint

[B] Meeting point

[C] Firewall point

[D] Securepoint

74. Choose the correct expression from the following for the length of UDP datagram.

[A] UDP length = IP length – IP header's length

[B] UDP length = UDP length – UDP header's length

[C] UDP length = IP length + IP header's length

[D] UDP length = UDP length + UDP header's length

75. If a processor clock is rated as 1250 million cycles per second, then its clock period is

[A] 1·9*10^–10 sec

[B] 1·6*10^–9 sec

[C] 1·25*10^–10 sec

[D] 8*10^–10 sec

76. A program consists of four major types of instructions. The instructions mix and the CPI for each instruction type are given in the following table. If the clock frequency of the processor is 400 MHz, what is the average CPI of the processor?

Instruction Type	CPI	Instruction Mix
Arithmetic and Logic	1	60%
Load/Store with cache hit	2	18%
Branch	4	12%
Memory reference with cache miss	8	10%

[A] 3·75

[B] 2·24

[C] 1·87

[D] 1·54

77. A hypothetical control unit supports 5 groups of mutually exclusive control signals. The number of bits that can be saved using vertical approach compared to horizontal is

Groups	G_1	G_2	G_3	G_4	G_5
#control signals	1	5	7	15	8

[A] 22

[B] 36

[C] 14

[D] 4

78. A device has been used in cycle stealing mode of DMA. A word of 4 bytes can be transferred when it is available. The memory cycle time is 40 ms and CPU is idle for 10% of its time. What is the data transfer rate of the device?

[A] 1011 bits/sec

[B] 11.11 B/sec

[C] 12.33 B/sec

[D] 2048 B/sec

79. Consider the following C program.

```
struct listnode
{
int data;
struct listnode *next;
}
void fun (struct listnode *head);
{
if(head= = NULL || head → next ==
                        NULL) return;
struct listnode *tmp = head →
                                next;
head → next = tmp → next;
free (tmp);
fun (head → next);
}
```

What is the functionality of the above function?

[A] It reverses the linked list

[B] It deletes the linked list

[C] Alternate nodes will be deleted

[D] It reverses the linked list and deletes alternate nodes

80. Five items P, Q, R, S and T are pushed onto a stack one after another starting from P. The stack is popped four times and the popped elements are inserted into a queue. The two elements are deleted from the queue and pushed back onto the stack. Again one element is popped from the stack. The popped item is

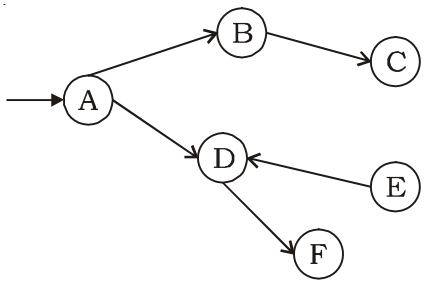
[A] P

[B] R

[C] Q

[D] S

81. What is the output of the BFS traversal of the graph below?



[A] A F D B C E

[B] C B A F D

[C] A B D C F

[D] F D C B A

82. Let A be an array of 31 numbers consisting of a sequence of 0's followed by a sequence of 1's. The problem is to find the smallest index i such that A[i] is 1 by probing the minimum number of locations in A. The worst-case number of probes performed by an optimal algorithm is

[A] 8

[B] 4

[C] 5

[D] 10

83. There are n unsorted arrays : A_1, A_2, ..., A_n. (Assume that n is odd) Each of A_1, A_2, ..., A_n contains n distinct elements. There are no common elements between any two arrays. The worst-case time complexity of computing the median of the medians of A_1, A_2, ..., A_n is

[A] O(n)

[B] O(nlogn)

[C] $O(n^2)$

[D] $O(n^2/\log n)$

84. If L is a regular language over $\Sigma = \{a,b\}$, which one of the following languages is ***not*** regular?

[A] $L \cdot L^R \{xy \mid x \in L, y^R \in L\}$

[B] Suffix(L) = $\{y \in \Sigma^* \mid \exists\, x \in \Sigma^*$ such that $xy \in L\}$

[C] Prefix(L) = $\{x \in \Sigma^* \mid \exists\, y \in \Sigma^*$ such that $xy \in L\}$

[D] $\{ww^R \mid w \in L\}$

85. The context-free grammar $S \rightarrow A111 \mid S1$, $A \rightarrow A0 \mid 00$ is equivalent to

[A] $\{0^n1^m \mid n=2, m=3\}$

[B] $\{0^n1^m \mid n=1, m=5\}$

[C] $\{0^n1^m \mid$ n should be greater than two and m should be greater than four$\}$

[D] $\{0^n1^m \mid$ n should be less than four and m should be less than three$\}$

86. Following context-free grammar

$S \rightarrow aB \mid bA$

$A \rightarrow b \mid aS \mid bAA$

$B \rightarrow b \mid bS \mid aBB$

generates strings of terminals that have

[A] equal number of a's and b's

[B] odd number of a's and odd number of b's

[C] even number of a's and even number of b's

[D] odd number of a's and even number of a's

87. Assuming $P \neq NP$, which of the following is ***true***?

[A] NP–complete = NP

[B] NP–complete $\cap$ P = ϕ

[C] NP–hard = NP

[D] P = NP–complete

88. A lexical analyzer uses the following patterns to recognize three tokens T_1, T_2 and T_3 over the alphabet {a, b, c}.

T_1:a?(b | c)*a

T_2:b?(a | c)*b

T_3:c?(b | a)*c

Note that 'x?' means 0 or 1 occurrence of the symbol x. Note also that the analyzer outputs the token that matches the longest possible prefix. If the string bbaacabc is processed by the analyzer, which one of the following is the sequence of tokens it outputs?

[A] $T_1T_2T_3$

[B] $T_1T_1T_3$

[C] $T_2T_1T_3$

[D] T_3T_3

89. Consider the CFG with {S,A,B} as the non-terminal alphabet, {a,b} as the terminal alphabet, S as the start symbol and the following set of production rules :

$S \rightarrow bA$ $\quad$ $S \rightarrow aB$

$A \rightarrow a$ $\quad$ $B \rightarrow b$

$A \rightarrow aS$ $\quad$ $B \rightarrow bS$

$S \rightarrow bAA$ $\quad$ $B \rightarrow aBB$

Which of the following strings is generated by the grammar?

[A] aaaabb

[B] aabbbb

[C] aabbab

[D] Abbba

90. Which of the following derivations does a top-down parser use while parsing an input string? The input is assumed to be scanned in left to right order.

[A] Leftmost derivation

[B] Leftmost derivation traced out in reverse

[C] Rightmost derivation

[D] Rightmost derivation traced out in reverse

91. Restricting the child process to a subset of the parent's resources prevents any process from

[A] overloading the system by using a lot of secondary storage

[B] underloading the system by very less CPU utilization

[C] overloading the system by creating a lot of sub-processes

[D] crashing the system by utilizing multiple resources

92. 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] 2

[B] 3

[C] 4

[D] 1

93. 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)

94. Consider two relations R_1(A,B) with the tuples (1,5), (3,7) and R_2(A,C) = (1,7), (4,9). Assume that R(A,B,C) is the full natural outer join of R_1 and R_2. Consider the following tuples of the form (A,B,C):

a = (1,5, null), b = (1,null,7), c = (3,null,9), d = (4,7,null), e = (1,5,7), f = (3,7,null), g = (4,null,9).

Which one of the following statements is ***correct***?

[A] R contains a, b, e, f, g but not c, d

[B] R contains all of a, b, c, d, e, f, g

[C] R contains e, f, g but not a, b

[D] R contains e but not f, g

95. Consider the relation X(P, Q, R, S, T, U) with the following set of functional dependencies

F = {

$\{P, R\} \rightarrow \{S, T\}$;

$\{P, S, U\} \rightarrow \{Q, R\}$

}

Which of the following is the trivial functional dependency in F^+, where F^+ is closure of F?

[A] $\{P, R\} \rightarrow \{S, T\}$

[B] $\{P, R\} \rightarrow \{R, T\}$

[C] $\{P, S\} \rightarrow \{S\}$

[D] $\{P, S, U\} \rightarrow \{Q\}$

96. A clustering index is defined on the fields which are of the type

[A] non-key and ordering

[B] non-key and non-ordering

[C] key and ordering

[D] key and non-ordering

97. In a file with 1 million records and with an order of the tree being 100, find out the maximum number of nodes to be accessed if B+ tree index is used.

[A] 5

[B] 4

[C] 3

[D] 10

98. Two-phase protocol in database management system is

[A] a concurrency mechanism that is deadlock free

[B] a recovery protocol used for restoring a database after a crash

[C] any update to the system log done in 2 phases

[D] not effective in database

99. A channel has a bit rate of 4 kbps and one-way propagation delay of 20 ms. The channel uses stop and wait protocol. The transmission time of the acknowledgement frame is negligible. To get a channel efficiency of at least 50%, the minimum frame size should be

[A] 80 bytes

[B] 80 bits

[C] 160 bytes

[D] 160 bits

100. If a browser sends a request to remote server to access a web page, then which among the following is the correct sequence to send the packet over the network from a host? (Assume that the host has just restarted)

[A] HTTP GET request, DNS query, TCP SYN

[B] DNS query, HTTP GET request, TCP SYN

[C] DNS query, TCP SYN, HTTP GET request

[D] TCP SYN, DNS query, HTTP GET request

SPACE FOR ROUGH WORK

★★★