1. In a compiler, keywords of a language are recognized during

(A) parsing of the program (B) the code generation
(C) the lexical analysis of the program (D) dataflow analysis

Explanation:
Lexical analysis includes recognition of keywords and identifiers

2. An algorithm to find the length of the longest monotonically increasing sequence starting at index i in the array.
Initialize $L_{n-1} = 1$
For all i such that $0 \leq i \leq n-2$

$$L_i = \begin{cases} 1 + L_{i+1} & \text{if } A[i] < A[i+1] \\ 1 & \text{otherwise} \end{cases}$$

Finally the length of the longest monotonically increasing sequence is Max(L0, L1, ..., Ln-1).
Which of the following statement is **TRUE**?

(A) The algorithm uses dynamic programming paradigm
(B) The algorithm has a linear complexity and uses branch and bound paradigm
(C) The algorithm has a non-linear polynomial complexity and uses branch and bound paradigm
(D) The algorithm uses divide and conquer paradigm.

Explanation:
It can be shown that algorithm has a linear complexity. As the array can be calculated from right to left in a single go. However it doesnot uses branch and bound paradigm. The branch and bound paradigm generally used to solve NP-hard problems. As it remove the recursions by solving each subproblems only once it reflects the dynamic programming paradigm.

3. How many distinct stages are there in DES algorithm, which is parameterized by a 56-bit key?

A) 16
B) 17
C) 18
D) 19

Ans:
DES(Data Encryption Standard) algorithm which is parameterized by a 56 bit key has 19 distinct stages including 16 rounds or repetition so ans is D

4. When data and acknowledgement are sent in the same frame, this is called as
(A) Piggy packing

(B) Piggy backing
(C) Back packing
(D) Good packing

Ans: Piggybacking is a process of attaching acknowledgment with the data packet to be sent. It is an efficient solution for reducing the bandwidth utilization of the network.

5. Given the following statements:

S1: A foreign key declaration can always be replaced by an equivalent check assertion in SQL.

S2: Given the table R(a,b,c) where a and b together form the primary key, the following is a valid table definition.

```
CREATE TABLE S (
 a INTEGER,
 d INTEGER,
 e INTEGER,
 PRIMARY KEY (d),
 FOREIGN KEY (a) references R)
```

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

A) S1 is True and S2 is False
B) Both S1 and S2 is True
C) S1 is False and S2 is True
D) Both S1 and S2 is False

(D) Both are false.

S1: Foreign key constraint means a lot of constraints it has to be a primary key(which in turn has few constraints).

Alternate reason: Using a check condition we can have the same effect as Foreign key while adding elements to the child table. But when we delete an element from the parent table the referential integrity constraint is no longer valid. So, a check constraint cannot replace a foreign key.
So, we cannot replace it with a single check.

S2: if a and b form a primary key in R, a alone cannot form a foreign key. i.e. $R(\underline{a, b}, c)$ and $S(a, d, e)$, a of S references to a of R, but a of R is not candidate key, instead a prime attribute since a, b combined is a key.

Foreign key definition: it should be a candidate key in some other table(in our case it is only a prime attribute).

6. A relational schema for a train reservation database is given below.
Passenger (pid, pname, age)
Reservation (pid, class, tid)

Table: Passenger

pid	pname	age
0	Sachin	65
1	Rahul	66
2	Sourav	67
3	Anil	69

Table : Reservation

pid	class	tid
0	AC	8200
1	AC	8201
2	SC	8201
5	AC	8203
1	SC	8204
3	AC	8202

What pids are returned by the following SQL query for the above instance of the tables?

```
SELECT pid
FROM Reservation ,
WHERE class ‘AC’ AND
    EXISTS (SELECT *
       FROM Passenger
       WHERE age > 65 AND
       Passenger. pid = Reservation.pid)
```

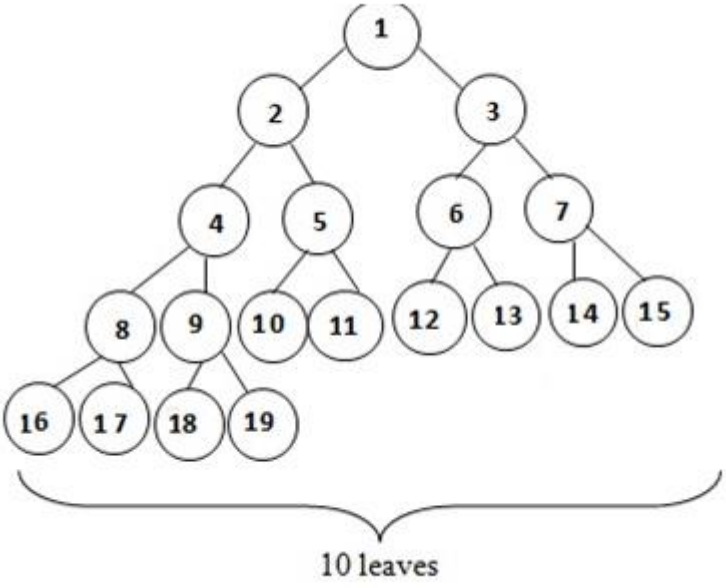
(A) 1, 0
(B) 1, 2
(C) 1, 3
(D) 1, 5

Answer: (C)

Explanation: When a subquery uses values from outer query, the subquery is called correlated subquery. The correlated subquery is evaluated once for each row processed by the outer query.
The outer query selects 4 entries (with pids as 0, 1, 5, 3) from Reservation table. Out of these selected entries, the subquery returns Non-Null values only for 1 and 3.

8. A binary tree in which every non-leaf node has non-empty left and right subtrees is called a strictly binary tree. Such a tree with 10 leaves.

(a) maximum 19 nodes
(b) has exactly 19 nodes
(c) has exactly 17 nodes
(d) cannot have more than 17 nodes
Solution: Option (b)
Explanation:
The configuration of 10 leaves can only be of the following way:



Any tree with n-leaves, for strict binary tree has (2n-1) nodes.

1. 9. The most appropriate matching for the following pairs

   X: m=malloc(5); m= NULL;

   Y: free(n); n->value = 5;

   Z: char *p; *p='a';

   1: using dangling

   2: using uninitialized pointers

   3. lost memory

   is:

   a. X-1 Y-3 Z-2
   b. X-2 Y-1 Z-3
   c. X-3 Y-2 Z-1
   d. X-3 Y-1 Z-2

   Answer (d)

10. To put the 8085 microprocessor in the wait state
(A) lower the-HOLD input
(B) lower the READY input
(C) raise the HOLD input
(D) raise the READY input

Answer: (B)

Explanation:

- If ready pin is high the microprocessor will complete the operation and proceeds for the next operation.
- If ready pin is low the microprocessor will wait until it goes high.
  Thus, option (B) is the answer.

11. The most appropriate matching for the following pairs

```
X: Indirect addressing          1 : Loops

Y: Immediate addressing         2 : Pointers

Z: Auto decrement addressing    3: Constants
```

is
(A) X-3, Y-2, Z-1
(B) X-I, Y-3, Z-2
(C) X-2, Y-3, Z-1
(D) X-3, Y-l, Z-2

Answer: (C)

Explanation: Explanation:
In **Indirect addressing mode** the instruction does not have the address of the data to be operated on, but the instruction points where the address is stored (it is indirectly specifying the address of memory location where the data is stored or to be stored)
In **immediate addressing mode** the data is to be used is immediately given in instruction itself; so it deals with constant data.

In **Autodecrement addressing mode**, Before determining the effective address, the value in the base register is decremented by the size of the data item which is to be accessed.
Within a loop, this addressing mode can be used to step backwards through all the elements of an array or vector.

So (C) is correct option.

12. Match the following vi commands in Unix:

List – I		**List – II**
a. : w	i.	saves the file and quits editing mode
b. : x	ii.	escapes unix shell
c. : q	iii.	saves file and remains in editing mode
d. : sh	iv.	quits editing mode and no changes are saved to the file

Codes :

	a	b	c	d
(1)	ii	iii	i	iv
(2)	iv	iii	ii	i
(3)	iii	iv	i	ii
(4)	iii	i	iv	ii

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

Answer: (D)

Explanation:

1. **w** vi command in unix saves file and remains in editing mode.
2.
3. **x** vi command in unix saves the file and quits editing mode
4. **q** vi command in unix quits editing mode and no changes are saved to the file
5. **sh** vi command in unix escapes unix shell

So, option (D) is correct.

13. Which of the following commands or sequences of commands will rename a file x to file y in a Unix system?

I. mv y, x

II. mv x, y

III. cp y, x (rm x)

IV. cp x, y (rm x)
(A) II and III
(B) II and IV
(C) l and III
(D) II only

Answer: (B)

Explanation: I. mv y, x //will move contents of file x to file y
II. mv x, y **//will move contents of file y to file x**
III. cp y, x (rm x) //will copy file x to file y (removal of x after the command)

IV. cp x, y (rm x) **//will move contents file y to file x (removal of x after the command**)

Hence Answer B

14. A disk has 200 tracks (numbered 0 through 199). At a given time, it was servicing the request of reading data from track 120, and at the previous request, service was for track 90. The pending requests (in order of their arrival) are for track numbers.

30 70 115 130 110 80 20 25.

How many times will the head change its direction for the disk scheduling policies SSTF(Shortest Seek Time First) and FCFS (First Come First Serve)
(A) 2 and 3
(B) 3 and 3
(C) 3 and 4
(D) 4 and 4

Answer: (C)

Explanation:
According to Shortest Seek Time First**:**
90-> **120-> 115**-> **110-> 130-> 80**-> 70-> 30-> 25-> 20

Change of direction**(Total 3);** 120->15; 110->130; 130->80
According to First Come First Serve:

90-> **120-> 30-> 70-**> 115-> **130-> 110**-> 80-> **20-> 25**
Change of direction**(Total 4);** 120->30; 30->70; 130->110;20->25
Therefore,Answer is C

15. Matching:

(a)	Huffman Code	(i)	$O(n^2)$
(b)	Optical Polygon Triangulation	(ii)	$\theta(n^2)$
(c)	Activity Selection Problem	(iii)	$O(n \lg n)$
(d)	Quicksort	(iv)	$\theta(n)$

Codes :

A) (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)
B) (a)-(i), (b)-(iv), (c)-(ii), (d)-(iii)
C) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
D) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

Ans: a) Huffman codes : $\theta(n)$

(b) Optimal polygon triangulation : $\theta(n^3)$

(c) Activity selection problem : O(n log n)

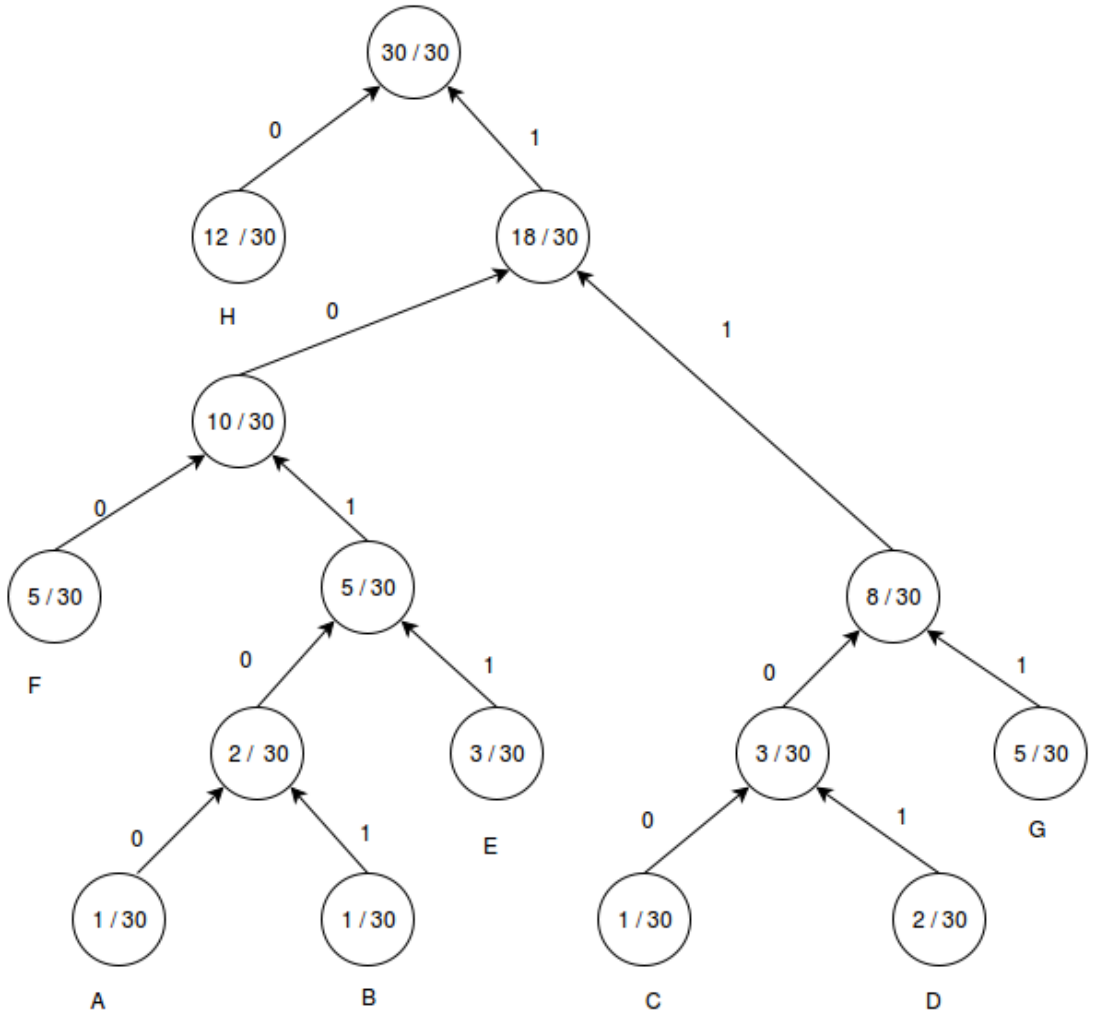
(d) Quick sort : $O(n^2)$

Time complexity of the Huffman algorithm is O(n Logn). If we know that the given array is sorted (by non-decreasing order of frequency), but we can generate Huffman codes in O(n) time.

16.

Given the symbols A, B, C, D, E, F, G and H with the probabilities $\frac{1}{30}$, $\frac{1}{30}$, $\frac{1}{30}$, $\frac{2}{30}$, $\frac{3}{30}$, $\frac{5}{30}$, $\frac{5}{30}$ and $\frac{12}{30}$ respectively. The average Huffman code size in bits per symbol is

A. $\frac{67}{30}$
B. $\frac{70}{34}$
C. $\frac{76}{30}$
D. $\frac{78}{30}$



A – 10100 – 5 bits

B – 10101 – 5 bits
C – 1100 – 4 bits
D – 1101 – 4 bits
E – 1011 – 4 bits
F – 100 – 3 bits
G – 111 – 3 bits
H – 0 – 1 bit
average Huffman code size = 5 * (1 / 30) + 5 * (1 / 30) + 4 * (2 / 30) + 4 * (3 / 30) + 3 * (5 / 30) + 3 * (5 / 30) + 1 * (12 / 30) = 76 / 30.
So, option (C) is correct.

18.

If a class B network on the Internet has a subnet mask of 255.255.248.0, what is the maximum number of hosts per subnet? (A) 1022 (B) 1023 (C) 2046 (D) 2047

Ans:

11111111 11111111 11111000 00000000 is binary representation of 255.255.248.0. So the formula is the remaining zero is:
The power of 2 minus 2=maximum number of host per subnet
Our case: 2^11-2=2046

19.

In Cyrus-Beck algorithm for line clipping the value of t parameter is computed by the relation:
(Here P 1 and P 2 are the two end points of the line, f is a point on the boundary, n 1 is inner normal)
(A) $(P_i – f_i). n_i / (P_2 – P_2). n_i$
(B) $(f_i – P_i). n_i / (P_2 – P_1). n_i$
(C) $(P_2 – f_i). n_i / (P_1 – P_2). n_i$
(D) $(f_i – f_i). P_2 / (P_1 – P_2). n_i$

Answer: (B)

20.

A priority queue is implemented as a Max-Heap. Initially, it has 5 elements. The level-order traversal of the heap is: 10, 8, 5, 3, 2. Two new elements 1 and 7 are inserted into

the heap in that order. The level-order traversal of the heap after the insertion of the elements is:

(A)
10, 8, 7, 3, 2, 1, 5

(B)
10, 8, 7, 2, 3, 1, 5

(C)
10, 8, 7, 1, 2, 3, 5

(D)
10, 8, 7, 5, 3, 2, 1

Answer: (A)

Explanation:

```
Initially heap has 10, 8, 5, 3, 2
    10
   /  \\
  8    5
 / \\
3   2


After insertion of 1
     10
   /   \\
  8     5
 / \\   /
3   2 1
No need to heapify as 5 is greater than 1.



After insertion of 7
     10
```

```
   /   \\
  8     5
 / \\   / \\
3   2 1   7
```

Heapify 5 as 7 is greater than 5

```
     10
   /   \\
  8     7
 / \\   / \\
3   2 1   5
```

No need to heapify any further as 10 is

greater than 7

Hence Option(A) is the correct answer.

21.

A text is made up of the characters a, b, c, d, e each occurring with the probability 0.11, 0.40, 0.16, 0.09 and 0.24 respectively. The optimal Huffman coding technique will have the average length of:

(A)
2.40

(B)
2.16

(C)
2.26

(D)
2.15

Answer: (B)

Explanation:

a = 0.11 b = 0.40 c = 0.16 d = 0.09 e = 0.24 we will draw a huffman tree: now huffman coding for character:

a = 1111

```
      b = 0
      c = 110
      d = 1111
      e = 10
length for each character = no of bits * frequency of occurrence:
a = 4 * 0.11
  = 0.44
b = 1 * 0.4
  =  0.4
c = 3 * 0.16
  = 0.48
d = 4 * 0.09
  =  0.36
e = 2 * 0.24
  = 0.48
Now add these lenght for average length:
 0.44 + 0.4 + 0.48 + 0.36 + 0.48 = 2.16
```

So, option (B) is correct.

22.

consider an open address hash table with a total of 10000 slots containing 9800 entries.
a) 2
b) 3
c) 4
d) 4.5

Given, **Open address hash table**

No of slots (m) = 10000

No of Keys (n) = 9800

Then

Load factor (α) = ($\frac{n}{m}$) = ($\frac{9800}{10000}$) = 0.98

and There is a theorem in CLRS, (you can check that.) which states that, expected number of probes in a successful search is at most ($\frac{1}{\alpha} ln \frac{1}{1-\alpha}$)

Hence answer will be = ($\frac{1}{0.98} ln \frac{1}{1-0.98}$)

= 3.991860..

= 4

Hence Answer will be **(C). 4**

23.

A counting semaphore is initialized to 8. 3 wait() operations and 4 signal() operations are applied. Find the current value of semaphore variable.

1. **1.** 9
2. **2.** 4
3. **3.** 1
4. **4.** 4

Answer : 1. 9

Explanation

In counting semaphore, Wait operations will decrease the value and signal operations will increase the value.
Initially counting semaphore value is 8.
3 Wait operations= - 3
4 Signal operation= + 4
= 8 - 3 + 4
= 5 + 4
= 9

So, option 1 is correct answer

24.

A* algorithm is guaranteed to find an optimal solution if

A. h’ is always 0
B. g is always 1
C. h’ never overestimates h
D. h’ never underestimates h

Ans:

Answer : **h’ never overestimates h**

A* is a computer algorithm that is widely used in path-finding and graph traversal.

Description : A* is an informed search algorithm, or a best-first search, meaning that it solves problems by searching among all possible paths to the solution (goal) for the one that incurs the smallest cost (least distance travelled, shortest time, etc.), and among these paths it first considers the ones that appear to lead most quickly to the solution. It is formulated in terms of weighted graphs, starting from a specific node of a graph, it constructs a tree of paths starting from that node, expanding paths one step at a time, until one of its paths ends at the predetermined goal node.

25. Consider a system with byte-addressable memory, 32 bit logical addresses, 4 kilobyte page size and page table entries of 4 bytes each. The size of the page table in the system in megabytes is _____
(A) 2
(B) 4
(C) 8
(D) 16

Answer: (B)

Explanation:

Number of entries in page table = 2^{32} / 4Kbyte
= 4 Megabytes