Question Answer

1.A decimal number has 30 digits. Approximately, how many digits would the binary representation have?

A. 30
B. 60
C. 90
D. 120

Maximum 30 digit decimal number = 10^30 -1

Maximum n bit binary number = 2^n - 1

10^30 - 1 = 2^n - 1

n = 30log 10

n = 30*(3.219280948873626)

= 99.657 (approx)

2. A pipeline P operating at 400 MHz has a speedup factor of 6 and operating at 70% efficiency. How many stages are there in the pipeline?
(A) 5
(B) 6
(C) 8
(D) 9

Answer: (D)

Explanation: Efficiency = Speedup factor/ Number of stages
0.7 = 6 / Number of stages
Number of stages = 8.56 = 9
So, option (D) is correct.

3. Two eight bit bytes 1100 0011 and 0100 1100 are added. What are the values of the overflow, carry and zero flags respectively, if the arithmetic unit of the CPU uses 2's complement form?
(A) 0, 1, 1
(B) 1, 1, 0
(C) 1, 0, 1
(D) 0, 1, 0

Answer: (D)

Explanation:

```
Addition of two numbers = 1100 0011
                           0100 1100
                          -----------
                          10000 1111
```

since, carry in and carry out of most significant bit is same, so, no overflow.
so, overflow flag = 0, carry flag = 1 and zero flag = 0.
Option (D) is correct.

4. Consider a computer system with ten physical page frames. The system is provided with an access sequence a1, a2, …, a20, a1, a2, …, a20), where each ai number. The difference in the number of page faults between the last-in-first-out page replacement policy and the optimal page replacement policy is _____

[Note that this question was originally Fill-in-the-Blanks question]
(A) 0
(B) 1
(C) 2
(D) 3

Answer: (B)

Explanation: LIFO stands for last in, first out
a1 to a10 will result in page faults, So 10 page faults from a1 to a10.
Then a11 will replace a10(last in is a10), a12 will replace a11 and so on till a20, so 10 page faults from a11 to a20 and a20 will be top of stack and a9…a1 are remained as such.
Then a1 to a9 are already there. So 0 page faults from a1 to a9.
a10 will replace a20, a11 will replace a10 and so on. So 11 page faults from a10 to a20. So total faults will be 10+10+11 = 31.
Optimal
a1 to a10 will result in page faults, So 10 page faults from a1 to a10.
Then a11 will replace a10 because among a1 to a10, a10 will be used later, a12 will replace a11 and so on. So 10 page faults from a11 to a20 and a20 will be top of stack and a9…a1 are remained as such.
Then a1 to a9 are already there. So 0 page faults from a1 to a9.
a10 will replace a1 because it will not be used afterwards and so on, a10 to a19 will have 10 page faults.
a20 is already there, so no page fault for a20.
Total faults 10+10+10 = 30.
Difference = 1

---

5. The cardinality of the power set of {0,1,2,…,10} is _____

(A) 512
(B) 1024
(C) 2048
(D) 128

The cardinality of the power set of {0,1,2,..,10} is _____
Total number of elements in given set is 11.
So the cardinality of the power set of given set will be 2^11 => 2048

6. Given a flow graph with 10 nodes, 13 edges and one connected components, the number of regions and the number of predicate (decision) nodes in the flow graph will be

A. 4, 5
B. 5, 4
C. 3, 1
D. 13, 8

Ans : B

Predicate (decision) nodes are those nodes which has out degree atleast 2.

Region =13-10+2 = 5 [i.e. edges - vertex + (p+1)] since p= 1]

predicate nodes(P)=

= region = P+1 = 5

P = 4

so (B) is ans.

7. Which speed up could be achieved according to Amdahl's Law for infinite number of processes if 5% of a program is sequential and the remaining part is ideally parallel ?
(A) Infinite
(B) 5
(C) 20
(D) 50

Answer: (C)

Explanation: According to Amdahl's law speed up for infinite number of process:

```
S = 1 / (1-P)
```

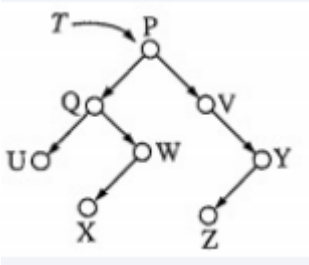
where p is parallel part of program

Given, sequential part of program is 5%. So parallel part of the program (P)

```
= 1 - sequential part

= 1 - 0.05 (or 5%)

= 0.95 (or 95%)


Now S = 1 / (1-P)

ie  S = 1 / (1-0.95)

    S = 1 / 0.05

    S = 20
```

So, option (C) is correct.

9. Consider the following binary search tree T given below: Which node contains the fourth smallest element in T?

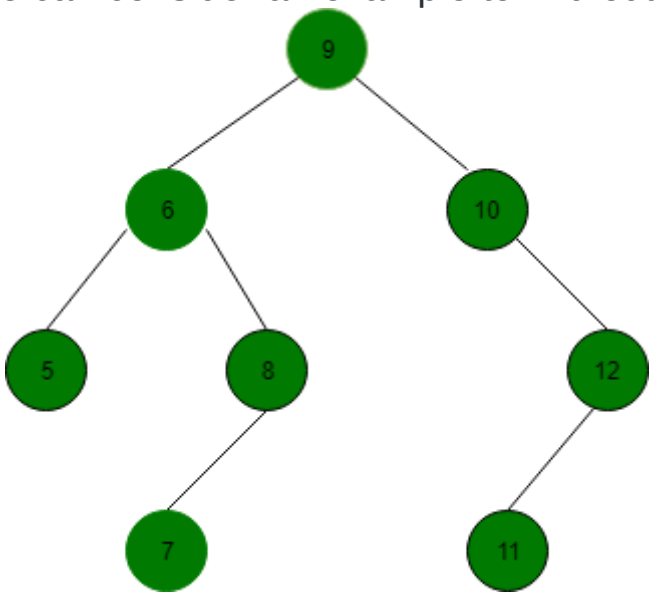


(A) Q
(B) V
(C) W
(D) X

Answer: (C)

Explanation: In a BST, value (left node) < value(root) < value(right

node) We can consider an example to find out the 4th smallest element:



From the above BST, we can clearly see that 8 is the fourth smallest element.
So, option (C) is correct.

10. **What is the output of Program?**

```
#include<stdio.h>

int main() {
int a = 5;
printf("%d%d%d", a++, a++, ++a);
}
```

Ans:

Note: *In* ***pre-increment****, i.e.,* ***++a****, it will increase the value by 1 before printing, and in* ***post-increment****, i.e.,* ***a++****, it prints the value at first, and then the value is incremented by 1.*

Answer: (D)

Explanation: When parameters are passed to a function, the value of every parameter is evaluated before being passed to the function.
What is the order of evaluation of parameters – left-to-right or right-to-left?
If evaluation order is left-to-right, then output should be 5 6 8 and if the evaluation order is right-to-left, then output should be 7 6 6. Unfortunately, there is no fixed order defined by C standard. A compiler may choose to evaluate either from left-to-right.

So the output is compiler dependent.

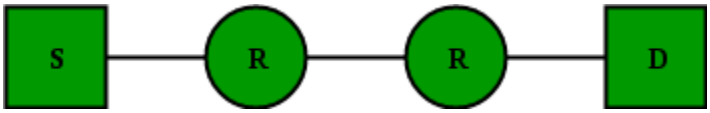
8. The cyclomatic complexity of each of the modules A and B shown below is 10. What is the cyclomatic complexity of the sequential integration shown on the right-hand side?

(A) 19
(B) 21
(C) 20
(D) 10

Answer: (A)

```
Cyclomatic Complexity of module = Number of decision points + 1

Number of decision points in A = 10 - 1 = 9
Number of decision points in B = 10 - 1 = 9
Cyclomatic Complexity of the integration = Number of decision
points + 1
                                         = (9 + 9) + 1
                                         = 19
```

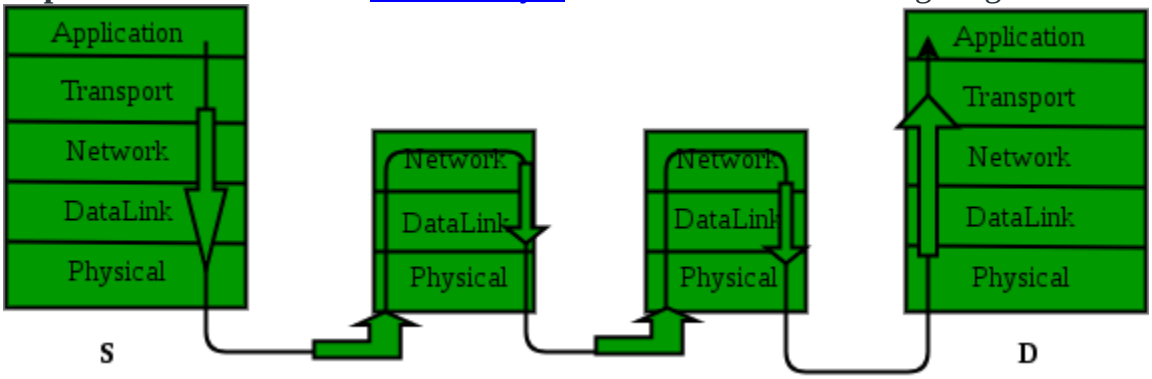
11. Assume that source S and destination D are connected through two intermediate routers labeled R. Determine how many times each packet has to visit the network layer and the data link layer during a transmission from S to D.



(A) Network layer – 4 times and Data link layer – 4 times
(B) Network layer – 4 times and Data link layer – 3 times
(C) Network layer – 4 times and Data link layer – 6 times
(D) Network layer – 2 times and Data link layer – 6 times

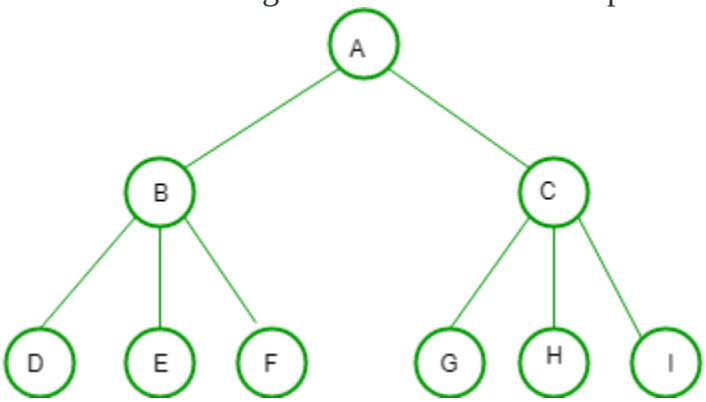
Answer: (C)

Explanation: Router is a network layer device. See the following diagram :



So every packet passes twice through data link layer of every intermediate router.

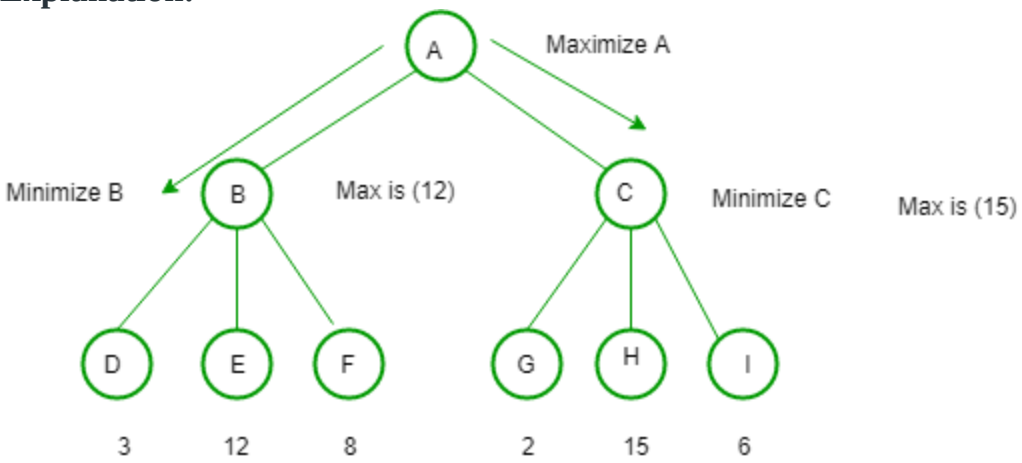
12. Consider the following game tree in which root is a maximizing node and children are visited left to right. What nodes will be pruned by the alpha-beta pruning ?



(A) I
(B) HI
(C) CHI
(D) GHI

Answer: (B)

Explanation:



We have to maximize A and minimize B and C. Minimum of B is 3 and C is 2 But max from B is 12 and max from C is 15. So, there is no need of further expanding H and I. Because whatever value their successor will produce will be immaterial. Hence H I are pruned. For more information on Game theory Refer:Minimax Algorithm in Game Theory | Set 4 (Alpha-Beta Pruning)
Option (B) is correct.

13. The coupling between different modules of a software is categorized as follows:

I. Content coupling
II. Common coupling
III. Control coupling
IV. Stamp coupling
V. Data coupling

Coupling between modules can be ranked in the order of strongest (least desirable) to weakest (most desirable) as follows:

A. I-II-III-IV-V
B. V-IV-III-II-I
C. I-III-V-II-IV
D. IV-II-V-III-I

Answer A

Coupling between modules can be ranked in the order of strongest to weakest as follows:

Content Coupling > Common Coupling > External Coupling > Control Coupling > Stamp Coupling > Data Coupling

- **Content Coupling:** Occurs when one module modifies or relies on the internal workings of another module
- **Common Coupling:** Occurs when two modules share the same global data
- **External Coupling:** Occurs when two modules share an externally imposed data format or communication protocol
- **Control Coupling:** One module controlling the flow of another, by passing it information
- **Stamp Coupling:** Occurs when modules share a composite data structure and use only parts of it
- **Data coupling:** Occurs when modules share data through parameters

14. How many programmable fuses are required in a PLA which takes 16 inputs and gives 8 outputs? It has to use 8 OR gates and 32 AND gates.

A. 1032
B. 776
C. 1284
D. 1536

answer is C)

Total programmable fuses= fuses required by AND gates + fuses required by OR gates

(Fuses are attached to and- or gate inputs to allow inputs to reach the and - or gates and If fuses don't work , then no input can reach to these gates of PLA)

Fuses required by AND gates = 2* no. Of inputs * no. Of and gates = 2*16*32= 1024 fuses

Fuses required by OR gates = no. Of outputs * no. Of and gates = 8* 32 = 256 (total outputs should be equal to no. Of OR gates and inputs have to cross AND gates and then goto OR gates)

Total fuses = 1024+ 256= 1280

15. Which of the following statements is the negation of statement "2 is even or -3 is negative"?

A) 2 is even and -3 is not negative

B) 2 is odd and -3 is not negative

c) 2 is even or -3 is negative

D) 2 is odd or -3 is negative

Solution:
Answer: B

Statement = 2 is even or -3 is negative

=> (statement)^1=(2 is even or -3 is negative)^1

=(2 is even)^1 and (-3 is negative)^1

= 2 is odd and −3 is not negative

16. Consider the following LPP :
Min Z = 2x1 + x2 + 3x3
Subject to :
x1 - 2x2 + x3 ≥ 4
2x1 + x2 + x3 ≤ 8
x1 - x3 ≥ 0
x1, x2, x3 ≥ 0
The solution of this LPP using the Dual Simplex Method is :
1. x1 = 0, x2 = 0, x3 = 3 and Z = 9
2. x1 = 0, x2 = 6, x3 = 0 and Z = 6
3. x1 = 4, x2 = 0, x3 = 0 and Z = 8
4. x1 = 2, x2 = 0, x3 = 2 and Z = 10

Ans:

060-305
IIx-09

2017

Q. Consider the following LPP:

Minimize $Z = 2x_1 + x_2 + 3x_3$

subject to : $x_1 - 2x_2 + x_3 \geq 4$

$2x_1 + x_2 + x_3 \leq 8$

$x_1 - x_3 \geq 0$

$x_1, x_2, x_3 \geq 0$

Sol^n I step in Dual Simplex method is to convert the given problem into canonical form.

In canonical form, given func. should be of max. type.

Thus, to make it max. prob., multiply both sides by -1. Thus objective func. now becomes :

$\text{Max}(-Z) = -2x_1 - x_2 - 3x_3$

subject to :

$-x_1 + 2x_2 - x_3 \leq -4$

$2x_1 + x_2 + x_3 \leq 8$

$-x_1 + x_3 \leq 0$

} constraints are also multiplied by (-1) to convert them in "$\leq$" constraints

II Step is to write the standard form :

$\text{Max}(-Z) = -2x_1 - x_2 - 3x_3 + 0S_1 + 0S_2 + 0S_3$

subject to : $-x_1 + 2x_2 - x_3 + S_1 = -4$

$2x_1 + x_2 + x_3 + S_2 = 8$

$-x_1 + x_3 + S_3 = 0$

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Iteration 1

C_B	B.V	x_1	x_2	x_3	S_1	S_2	S_3	Solution
	C_j	-2	-1	-3	0	0	0	
0	S_1	-1	2	-1	1	0	0	-4
0	S_2	2	1	1	0	1	0	8
0	S_3	-1	0	1	0	0	1	0
	Z_j	0	0	0	0	0	0	
	$C_j - Z_j$	-2	-1	-3	0	0	0	

∵ $C_j - Z_j \leq 0$ for all values ⇒ Optimal
and all sol" values should be positive, which is not happening in our case ⇒ Not feasible

Since only one val. is negative, thus S_1 will leave.
If there had been 2 val., most negative should be chosen.

For determination of entering variable:

variables	x_1	x_2	x_3	S_1	S_2	S_3
$C_j - Z_j$	-2	-1	-3	0	0	0
leaving var (S_1)	-1	2	-1	1	0	0
ratio = $\frac{C_j - Z_j}{\text{leaving var.}}$	$\frac{-2}{-1} = 2$	—	$\frac{-3}{-1} = 3$	—	—	—

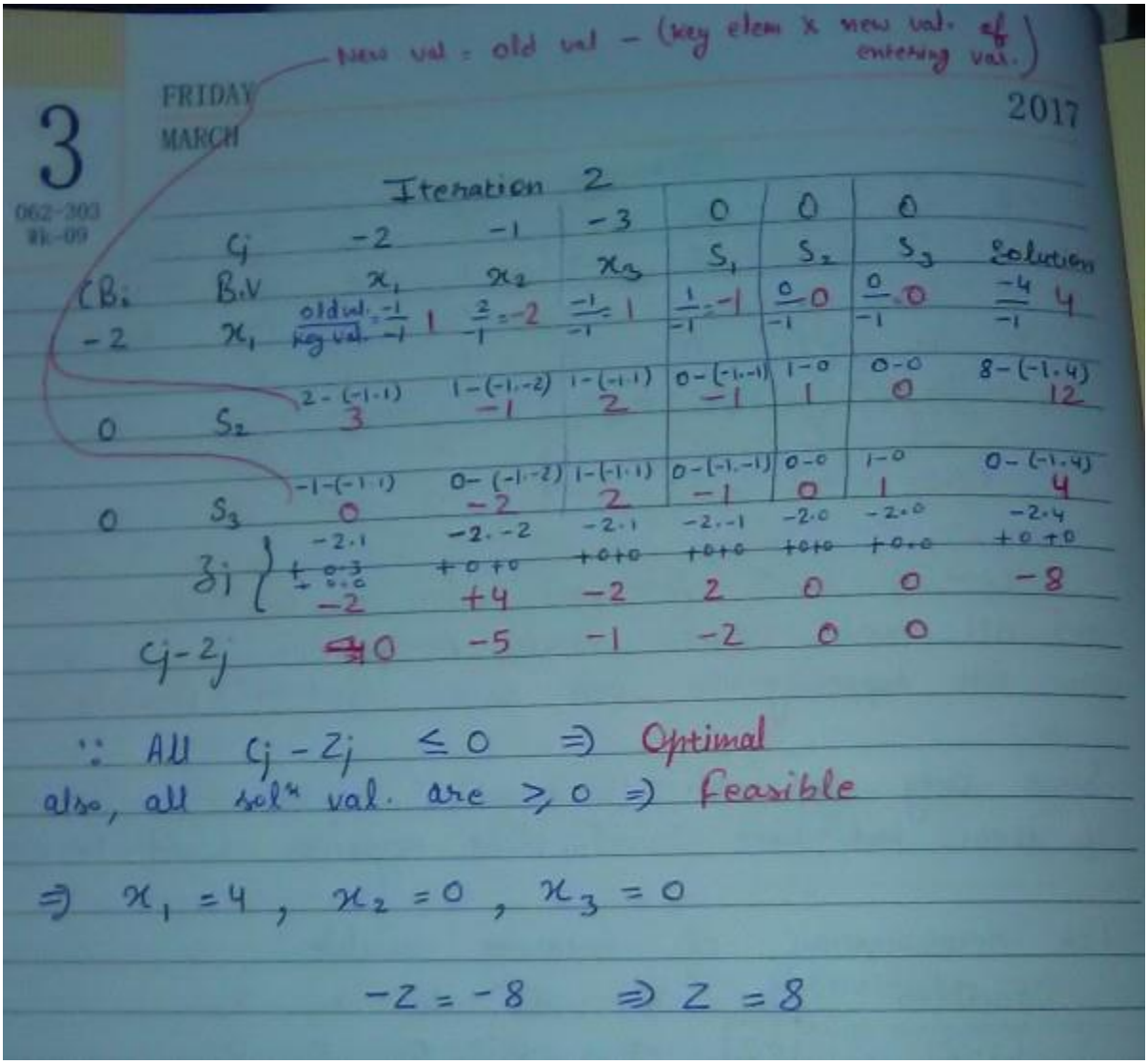
only if denominator is negative

∵ minimum ratio is 2, thus entering var. would be x_1

Iteration 1 - Table (Redesigned)

key elem. → -1	2	-1	1	0	0	-4 ← key row
2	1	1	0	1	0	8
-1	0	1	0	0	1	0

key col.



17. Suppose the time to service a page fault is on the average 10 milliseconds, while a memory access takes 1 microsecond. Then a 99.99% hit ratio results in average memory access time of (GATE CS 2000)

(A) 1.9999 milliseconds
(B) 1 millisecond
(C) 9.999 microseconds
(D) 1.9999 microseconds

Answer: (D)

Explanation: If any page request comes it will first search into page table, if present, then it will directly fetch the page from memory, thus in this case time requires will be only memory access time.
But if required page will not be found, first we have to bring it out and then go for memory access. This extra time is called page fault service time.

Let hit ratio be p , memory access time be t1 , and page fault service time be t2.

```
Hence, average memory access time = p*t1 + (1-p)*t2
                    =(99.99*1 +  0.01*(10*1000 + 1))/100
                                                    =1.9999
*10^-6 sec
```

18. Which of the following statement is true?
(A) SLR parser is more powerful than LALR.
(B) LALR parser is more powerful than Canonical LR parser.
(C) Canonical LR parser is more powerful than LALR parser.
(D) The parsers SLR, Canonical LR, and LALR have the same power.

Answer: (C)

Explanation: Canonical LR is the most powerful parser as compared to other LR parsers. Order: LR(0)< SLR < LALR < CLR. Option (C) is correct.

19. If G is an undirected planar graph on n vertices with e edges then

A) $e \leq n$
B) e ≤ 2n
C) e ≤ 3n
D) None of the option

Ans:

for **planar** graphs, 3r <= 2e and v - e + r = 2

From these we get e <= 3v - 6

Now 2v <= 3v - 6 for all vertices v >=3

So e <= 2n is the answer.

Theorem 1 (Euler's Formula) *Let G be a connected planar graph, and let* n, m *and* f *denote, respectively, the numbers of vertices, edges, and faces in a plane drawing of G. Then n-m+f=2*

20. **In an IPv4 packet, the value of HLEN is 1000 in binary. How many bytes of options are being carried by this packet?**
A) 8
B) 16
C) 32
D) 64
Ans:
If an IPv4 packet, the value of HLEN is 1000 in binary, then 32 bytes of options are carried by this packet.

HLEN = 1000 = 8

8*4 = 32

The value of HLEN in an IPv4 packet is used to indicate the length of the header in 32-bit words. In this case, the value of HLEN is 1000 in binary, which is equivalent to 8 in decimal. Therefore, the total number of bytes in the header is 8 × 4 = **32 bytes**. The first 20 bytes are the main header and the remaining 12 bytes are the options.

21. In a binary Hamming Code the number of check digits is r then number of message digits is equal to:
(A) $2^r - 1$
(B) $2^r - r - 1$
(C) $2^r - r + 1$
(D) $2^r + r - 1$

Answer: (B)

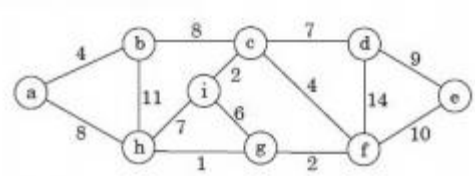
22. Using the RSA public key crypto system, if p=13, q=31 and d=7, then the value of e is

A. 101
B. 103
C. 105
D. 107

Ans:

Compute φ= $(p-1)(q-1)$ =12 x 30 =360
choose an int e such that 1<e<φ and e & φ are co-prime
d.e =1 mod φ
7. e=1 mod 360 =361 mod 360 =721 mod 360 =>7e=721 =>e=103
hence ans is B

23. Consider the undirected graph below:



Using Prim's algorithm to construct a minimum spanning tree starting with node ❓, which one of the following sequences of edges represents a possible order in which the edges would be added to construct the minimum spanning tree?

A. (a,b),(a,h),(g,h),(f,g),(c,f),(c,i),(c,d),(d,e)
B. (a,b),(b,h),(g,h),(g,i),(c,i),(c,f),(c,d),(d,e)
C. (a,b),(b,c),(c,i),(c,f),(f,g),(g,h),(c,d),(d,e)
D. (a,b),(g,h),(g,f),(c,f),(c,i),(f,e),(b,c),(d,e)

Ans:

Prim's algorithm may informally be described as performing the following steps:

1. Initialize a tree with a single vertex, chosen arbitrarily from the graph.
2. Grow the tree by one edge: of the edges that connect the tree to vertices not yet in the tree, find the minimum-weight edge, and transfer it to the tree.
3. Repeat step 2 (until all vertices are in the tree)

Here we have to start with vertex a so first edge must be (a,b) next either (b.c) or (a,h)
{hence option B,D are out if we go with (b,c) then next must be (c,i) followed by (c,f) (f,g) then (g,h) and (c,d) and (d,e)

which is option C) hence it is correct ans

if we go with (a,h) next must be (h,g) or (g,h) as in **option A hence is also correct** (although order is changed)

Both A, C are correct as per offiical key

24. Match the following :

I. 2 NF (a) transitive dependencies eliminated
II. 3 NF (b) multivalued attribute removed
III. 4 NF (c) contain no partial functional dependencies
IV. 5 NF (d) contains no join dependency

Codes :

I II III IV
(A) (a) (c) (b) (d)
(B) (d) (a) (b) (c)
(C) (c) (d) (a) (b)
(D) (d) (b) (a) (c)

Ans: B

25. Consider the following table structures related to a university for the below question.

EMPLOYEE

```
    NAME VARCHAR (30) NOT NULL,
    EID VARCHAR (10) NOT NULL,
    DEPTNO INT (5) NOT NULL,
    HODEID VARCHAR (10),
    SALARY INT (10),
PRIMARY KEY (EID),
FOREIGN KEY (HODEID) REFERENCES EMPLOYEE (EID),
FOREIGN KEY (DEPTNO) REFERENCES DEPARTMENT (DID);
```

DEPARTMENT

```
    DID INT (5) NOT NULL,
    DNAME VARCHAR(30) NOT NULL,
    HODID VARCHAR (10) NOT NULL,
    HODNAME VARCHAR (30),
PRIMARY KEY (DID),
UNIQUE (DNAME),
FOREIGN KEY (HODID) REFERENCES EMPLOYEE (EID)
```

PROJECT WORK:

```
    EMPID VARCHAR (10) NOTNULL,
    PROJNO INT(5) NOT NULL,
    PROJECTLOC VARCHAR (30) NOT NULL,
PRIMARY KEY (EMPID, PROJNO),
FOREIGN KEY (EMPID) REFERENCES EMPLOYEE (EID),
```

Refer table, structures given above, University decided to give all employees in the 'SCIENCE' department a 20% rise in salary. Which of the following query/queries will compute the above results?

```
a.
    1. UPDATE EMPLOYEE
```

```
2. SET SALARY = SALARY*1.20
3. WHERE DEPT NO. IN (SELECT DID FROM DEPARTMENT WHERE DNAME =
   'SCIENCE');
```

b.

```
1. UPDATE TABLE EMPLOYEE
2. SET SALARY = SALARY*1.20 WHERE DNAME='SCIENCE';
```

c.

```
1. ALTER TABLE EMPLOYEE
2. SET SALARY=SALARY*1.20
3. WHERE DEPTNO. IN (SELECT DNAME FROM DEPARTMENT WHERE DNAME =
   'SCEINCE')
```

Choose the correct answer from the options given below:

A. a and b only
B. a only
C. b and c only
D. c only

Proper syntax is

Update Tablename

hence option B(update **table** tablename and C (Alter table which is used for changing table structure or constraints) are out .

since DNAME is not a field in employee table we have to use nested query to match DID from other table

1. UPDATE EMPLOYEE
2. SET SALARY = SALARY*1.20
3. WHERE DEPT NO. IN (SELECT DID FROM DEPARTMENT WHERE DNAME = ‘SCIENCE’);

Ans is option option B) i.e statement A