GATE 2019
Computer Science & IT

Memory Based Questions and Solutions of forenoon session

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Q.1 The police has arrested four criminals P, Q, R and S.
   P : says Q committed crime
   Q : says S committed crime
   R : says “I didn’t do it”
   S : says what Q said about me is false.
   There is only one criminal and also only one of the above statements is correct. Who
   among the four committed the crime?
   (a) P  (b) Q  
   (c) R  (d) S

Q.2 Two cars start at same place in same direction at same time. Car ‘A’ has speed of 50
   km/hr, car ‘B’ has speed of 60 km/hr. After how many hours the distance between them
   will be 20 kms?
   (a) 24 (b) 2  
   (c) 5  (d) 3

Q.3 The court is for judge as a_______ to a teacher.
   (a) Syllabus (b) Punishment  
   (c) Student (d) School

Q.4 10 students decide to buy gift for their teacher. After buying gift, 2 of the students do
   not pay their share. Then share of the remaining students increases by 150 each. What
   is the cost of the gift?
   (a) 3000 (b) 6000  
   (c) 1200 (d) 666

Q.5 Consider the language: L = \{a^{2^k}b^{10+12k}\} for k \geq 0. Which of the following is correct
   for the length of string L to satisfy Pumping Lemma?
   (a) 5 (b) 24  
   (c) 9 (d) 3

Q.6 The search engine business model _______ around fulcrum of trust.
   (a) Sink  (b) Plays  
   (c) Revolves (d) #
Q.7 The expenditure of project ________as follows: (Expenditure: 20 lakhs, Salary: 12 lakhs, Contingency: 3 lakhs)
(a) Break (b) Breakdown
(c) Breaks (d) Breaks down

Q.8 Consider the following processes using preemptive shortest remaining time first.

<table>
<thead>
<tr>
<th></th>
<th>P_1</th>
<th>P_2</th>
<th>P_3</th>
<th>P_4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival time</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>CPU time</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>Z</td>
</tr>
</tbody>
</table>

If the average waiting time is 1 millions then what is the value of Z?

Q.9 Consider the following C program

```c
#include<stdio.h>
int r()
{
    Static int num = 7;
    return num--;}
int main()
{
    for ( r(); r(); r() )
        printf("%d",r());
    return 0;
}
```

What is the output of the above C program?
(a) 73 (b) 52 (c) 41 (d) 31

Q.10 Consider the cache memory size of 16 kB, and cache block size is 16 bytes. The processor generates the physical address of 32 bits. Assume the cache is fully associative. What are the TAG and index bits__________
(a) 28 and 4 bits (b) 24 and 4 bits
(c) 28 and 0 bits (d) 24 and 0 bits

Q.11 Which of the following protocol are used to send and retrieve emails respectively?
(a) SMTP and IMAP (b) SMTP and POP3
(c) IMAP and POP3 (d) POP3 and SMTP
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Q.12 What is the value of \[ \lim_{x \to 3} \frac{x^4 - 3^4}{2x^2 - 5x - 3} \]

(a) \( \frac{12}{7} \)  
(b) \( \frac{104}{12} \)  
(c) \( \frac{108}{7} \)  
(d) Limit not exists

Q.13 The chip selects logic for a certain DRAM chip in memory design shown. Assume that memory has 16 address of memory system (in hexadecimal) that can be enabled by chip select?

![Chip Select Logic Diagram]

(a) CA00 to CAFF  
(b) DA00 to DAFF  
(c) C800 to CFFF  
(d) C800 to C8FF

Q.14 Which of the following is not a valid identity

(a) \( x \oplus y = (xy + x'y') \)  
(b) \( (x + y) \oplus z = x \oplus (y + z) \)  
(c) \( x \oplus y = x + y \) if \( xy = 0 \)  
(d) \( (x \oplus y) \oplus z = x \oplus (y \oplus z) \)

Q.15 Let \( Z = X - Y \), \( X, Y, Z \) are signed magnitude numbers and \( X, Y \) are represented in \( n \)-bit numbers. To avoid overflow minimum number of bits would require for \( Z \) is _________

(a) \( n \)-bit  
(b) \( n + 2 \) bits  
(c) \( n + 1 \) bits  
(d) \( (n - 1) \) bits

Q.16 A network with three hosts \( M, N \) and \( P \) have IP address 194.56.10.2, 194.56.10.5 and 194.56.10.6 and their subnet mask is 255.255.255.252. Which of the following will be in a same subnet?

(a) All three will be in same subnet  
(b) \( M \) and \( N \)  
(c) \( N \) and \( P \)  
(d) All will be in different subnet
Q.17 From a complete binary tree $T$ of 8 leaf nodes, two nodes $a$ and $b$ are selected randomly and uniformly. What is the expected length (in edges) between $a$ and $b$ in $T$?

Q.18 What is the 2's complement representation for $-28$ in 16-bit register
(a) 1111 1111 1110 0100  
(b) 0000 0000 0010 0100  
(c) 1111 1111 1101 1000  
(d) 1111 1111 1111 1100

Q.19 In RSA algorithm, the value of $n$ is 3007 and the value of $\phi(n)$ is 2880 where $\phi$ is the Euler's totient function. What is the value of the prime factor which greater than 50?

Q.20 If 15 computers are to be connected using 8 port Ethernet switches, then the minimum numbers of switches required are _____. Assume no separate uplink port is available:

Q.21 Which of the following equivalent relation of a group $G$?

$R_1 : \forall a, b \in G, a R_1 b \text{ if only } \exists g \in G : a = g^{-1}bg$

$R_2 : \forall a, b \in G, a R_2 b \text{ if only } a = b^{-1}$

(a) Both $R_1$ and $R_2$  
(b) $R_1$  
(c) $R_2$  
(d) None of these

Q.22 Which of the following is not correct about B+ Tree, which is used for creating index of relational database table?

(a) Key values in each node kept in sorted order  
(b) Leaf node pointer points to next node  
(c) B+ tree is height balanced tree  
(d) Non-leaf node have pointers to data records

Q.23 The given functional dependency: $F = \{ QR \rightarrow S, R \rightarrow P, S \rightarrow Q \}$ holds as relational schema given for $X = PQRS$ and $X$ is not in BCNF. Now $X$ is decomposed into $Y = PR$ and $Z = QRS$, Consider the following statements.

(I) $Y$ and $Z$ are in BCNF  
(II) Decomposition of $X$ into $Y$ and $Z$ is dependency preserving and lossless join.
Which of the following is correct?

(a) I only  
(b) Neither I nor II  
(c) Both I and II  
(d) II only
Q.24  The output ‘\( f \)’ of the following circuit in minterms where
\[
\begin{align*}
\textbf{f}_1 &= \Sigma \text{m} (0, 2, 5, 8, 14) \\
\textbf{f}_2 &= \Sigma \text{m} (2, 3, 6, 8, 14, 15) \\
\textbf{f}_3 &= \Sigma \text{m} (2, 7, 11, 14)
\end{align*}
\]
(a) \( \Sigma \text{m} (2, 14) \)  \\
(b) \( \Sigma \text{m} (2, 7, 8, 11, 14) \)  \\
(c) \( \Sigma \text{m} (0, 2, 3, 5, 6, 7, 8, 11, 14, 15) \)  \\
(d) \( \Sigma \text{m} (7, 8, 11) \)

Q.25  Minimum number of 2-input NOR gates required to implement 4-variable function expressed in sum of minterms as \( f = \Sigma \text{m} (0, 2, 5, 7, 8, 10, 13, 15) \). Assume that all the inputs and their complements are available________.

Q.26  Assume INODE contains 12 direct pointers, 1 Single Indirect pointers and 1 Doubly Indirect pointer. The block size is 4 kB and pointer size is 32 bits. What is the maximum possible file size?____GB (Round off to 1 decimal places)

Q.27  Consider the following statements.
(i) In max Heap smallest element is at the leaf node.
(ii) In max Heap second largest element always the child of root.
(iii) Binary search tree can be constructed from max heap in \( \Theta(n) \).
(iv) Max Heap can be build from Binary search tree in \( \Theta(n) \)
Which of the above option is correct?
(a) (i), (ii) and (iii)  \\
(b) (i), (ii) and (iv)  \\
(c) (ii), (iii) and (iv)  \\
(d) (i), (iii) and (iv)
Q.28  Let $U = \{1, 2, \ldots, n\}$ and $A = \{(x, X), x \in X$ and $X \subseteq U\}$. Consider the following two statements for $|A|$.  
(i) $|A| = n \cdot 2^{n-1}$  
(ii) $|A| = \sum_{k=1}^{n} k \cdot \binom{n}{k}$  
Which of the following is correct? 
(a) (i) only  
(b) (ii) only  
(c) Both (i) and (ii)  
(d) None of the above

Q.29  Consider the following C programs.  
```c
int main()
{
    float sum, i = 1.0, j = 2.0;
    while (i/j > 0.0625)
    {
        j = j + j;
        printf("sum=\%f\n", i + j);
    }
}
```
The number of times printf statement is executed________.