Answer Key

of

Computer Science

GATE-2015

Afternoon Session | **7th Feb, 2015**

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Section - I (General Aptitude)

Q.1 We _____ our friend's birthday and we _____ how to make it up to him.

(a) Completely forgot --- don't just know
(b) Forgot completely --- don't just know
(c) Completely forgot --- just don't know
(d) Forgot completely --- just don't know

Ans. **(c)**

End of Solution

Q.2 Choose the statement where underlined word is used correctly.

(a) The industrialist had a personnel jet
(b) I write my experience in my personnel diary
(c) All personnel are being given the day off
(d) Being religious is a personnel aspect

Ans. **(c)**

End of Solution

Q.3 Consider a function $f(x) = 1 - |x|$ on $-1 \le x \le 1$. The value of x at which the function attains a maximum and the maximum value of the function are:

(a) 0, –1 (b) –1, 0
(c) 0, 1 (d) –1, 2

Ans. **(c)**

End of Solution

Q.4 A generic term that includes various items of clothing such as a skirt, a pair of trousers and a shirt is

(a) fabric (b) textile
(c) fibre (d) apparel

Ans. **(d)**

End of Solution

Q.5 Based on the given statements, select the most appropriate option to solve the given question. What will be the total weight of 10 poles each of same weight?

Statements:

1. One fourth of the weight of a pole is 5 Kg.
2. The total weight of these poles is 160 kg more than the total weight of two poles.

(a) Statement 1 alone is not sufficient
(b) Statement 2 alone is not sufficient
(c) Either 1 or 2 alone is sufficient
(d) Both statements 1 and 2 together are not sufficient

Ans. **(c)**

End of Solution

Q.6 If the list of letters, P, R, S, T, U is an arithmetic sequence, which of the following are also in arithmetic sequence?

1. 2P, 2R, 2S, 2T, 2U
2. P–3, R–3, S–3, T–3, U–3
3. P^2, R^2, S^2, T^2, U^2

(a) 1 only
(b) 1 and 2
(c) 2 and 3
(d) 1 and 3

Ans. **(b)**

End of Solution

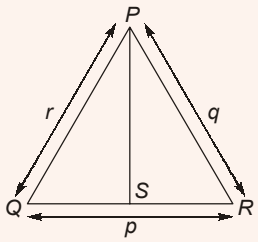
Q.7 Four branches of a company are located at M, N, O and P. M is north of N at a distance of 4 km; P is south of O at a distance of 2 km; N is southeast of O by 1 km. What is the distance between M and P in km?

(a) 5.34
(b) 6.74
(c) 28.5
(d) 45.49

Ans. **(a)**

End of Solution

Q.8 In a triangle PQR, PS is the angle bisector of $\angle QPR$ and $\angle QPS = 60°$. What is the length of PS?



(a) $\frac{(q+r)}{qr}$
(b) $\frac{qr}{(q+r)}$
(c) $\sqrt{(q^2+r^2)}$
(d) $\frac{(q+r)^2}{qr}$

Ans. **(b)**

End of Solution

Q.9 If p, q, r, s are distinct integers such that:

f(p, q, r, s) = max (p, q, r, s)

g(p, q, r, s) = min (p, q, r, s)

h(p, q, r, s) = remainder of (p × q) / (r × s) if (p × q) > (r × s) or remainder of (r × s) / (r × q) if (r × s) > (p × q)

Also a function fgh (p, q, r, s) = f(p, q, r, s) × g(p, q, r, s) × h(p, q, r, s).

Also the same operation are valid with two variable functions of the form f(p, q).

What is the value of fg(h(2, 5, 7, 3), 4, 6, 8)?

Ans. **(8)**

End of Solution

Q.10 Out of the following four sentences, select the most suitable sentence with respect to grammar and usage:

(a) Since the report lacked needed information, it was of no use to them

(b) The report was useless to them because there were no needed information in it

(c) Since the report did not contain the needed information, it was not real useful to them

(d) Since the report lacked needed information, it would not had been useful to them

Ans. **(a)**

End of Solution

Section - II (Computer Science & IT)

Q.1 Consider the following transaction involving two bank accounts x and y.

read (x) ; x := x – 50; write (x); read (y); y := y + 50; write (y)

The constraint that the sum of the accounts x and y should remain constant is that of

(a) Atomicity (b) Consistency

(c) Isolation (d) Durability

Ans. **(b)**

End of Solution

Q.2 Consider two decision problems Q_1, Q_2 such that Q_1 reduces in polynomial time to 3-SAT and 3-SAT reduces in polynomial time to Q_2. Then which one of the following is consistent with the above statement?

(a) Q_1 is in NP, Q_2 is NP hard (b) Q_2 is in NP, Q_1 is NP hard

(c) Both Q_1 and Q_2 are in NP (d) Both Q_1 and Q_2 are in NP hard

Ans. **(a)**

End of Solution

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Q.3 Consider the following two statements.
S1: If a candidate is known to be corrupt, then he will not be elected.
S2: If a candidate is kind , he will be elected.
Which one of the following statements follows from S1 and S2 as per sound inference rules of logic?
(a) If a person is known to be corrupt, he is kind
(b) If a person is not known to be corrupt, he is not kind
(c) If a person is kind, he is not known to be corrupt
(d) If a person is not kind, he is not known to be corrupt

Ans. **(c)**

End of Solution

Q.4 A Software Requirements Specification (SRS) document should avoid discussing which one of the following?
(a) User interface issues
(b) Non-functional requirements
(c) Design specification
(d) Interfaces with third party software

Ans. **(c)**

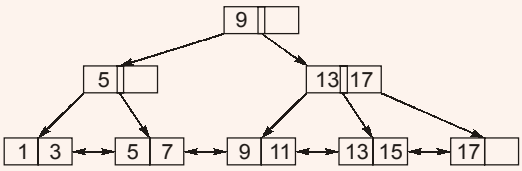
End of Solution

Q.5 The larger of the two eigenvalues of the matrix $\begin{bmatrix} 4 & 5 \\ 2 & 1 \end{bmatrix}$ is _____.

Ans. **(6)**

End of Solution

Q.6 With reference to the B^+ tree index of order 1 shown below, the minimum number of nodes (including the root node) that must be fetched in order to satisfy the following query: "Get all records with a search key greater than or equal to 7 and less than 15" is _____.



Ans. **(5)**

End of Solution

Q.7 The minimum number of JK flip-flops required to construct a synchronous counter with the count sequence (0, 0, 1, 1, 2, 2, 3, 3, 0, 0,...) is _____.

Ans. **(2)**

End of Solution

Q.8 A link has a transmission speed of 10^6 bits/sec. It uses data packets of size 1000 bytes each. Assume that the acknowledgment has negligible transmission delay, and that its propagation delay is the same as the data propagation delay. Also assume that the processing delays at 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 _____.

Ans. **(12)**

End of Solution

Q.9 The number of divisors of 2100 is _____.

Ans. **(36)**

End of Solution

Q.10 A binary tree T has 20 leaves. The number of nodes in T having two children is _____.

Ans. **(19)**

End of Solution

Q.11 Consider the following C function.

```
int fun (int n)
{
        int x=1, k;
        if (n==1) return x;
        for (k=1; k<n; ++k)
                x=x + fun (k) * fun (n – k);
        return x;
}
```

The return value of fun (5) is _____.

Ans. **(51)**

End of Solution

Q.12 Consider the basic COCOMO model where E is the effort applied in person-months, D is the development time in chronological months, KLOC is the estimated number of delivered lines of code (in thousands) and a_b, b_b, c_b, d_b have their usual meanings. The basic COCOMO equations are of the form.

(a) $E = a_b(KLOC)\ exp(b_b)$, $D = c_b(E)\ exp(d_b)$

(b) $D = a_b(KLOC)\ exp(b_b)$, $E = c_b(D)\ exp(d_b)$

(c) $E = a_b\ exp(b_b)$, $D = c_b(KLOC)\ exp(d_b)$

(d) $E = a_b\ exp(d_b)$, $D = c_b(KLOC)\ exp(b_b)$

Ans. **(a)**

End of Solution

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Q.13 Which one of the following statements is NOT correct about HTTP cookies?

(a) A cookies is a piece of code that has the potential to compromise the security of an Internet user

(b) A cookie gains entry to the user's work area through an HTTP header

(c) A cookie has an expiry date and time

(d) Cookies can be used to track the browsing pattern of a user at a particular site

Ans. **(b)**

End of Solution

Q.14 In the context of abstract-syntax-tree (AST) and control-flow-graph (CFG), which one of the following is True?

(a) In both AST and CFG, let node N_2 be the successor of node N_1. In the input program, the code corresponding to N_2 is present after the code corresponding to N_1

(b) For any input program, neither AST nor CFG will contain a cycle

(c) The maximum number of successors of a node in an AST and a CFG depends on the input program

(d) Each node in AST and CFG corresponds to at most one statement in the input program

Ans. **(c)**

End of Solution

Q.15 Consider the following function written in the C programming language.

```
void foo (char *a)
{
    if (*a && *a != ` `)
    {       foo (a+1);
            putchar (*a);
    }
}
```

The output of the above function on input "ABCD EFGH" is

(a) ABCD EFGH (b) ABCD

(c) HGFE DCBA (d) DCBA

Ans. **(d)**

End of Solution

Q.16 Let R be the relation on the set of positive integers such that aRb if and only if a and b are distinct and have a common divisor other than 1. Which one of the following statements about R is True?

(a) R is symmetric and reflexive but not transitive
(b) R is reflexive but not symmetric and not transitive
(c) R is transitive but not reflexive and not symmetric
(d) R is symmetric but not reflexive and not transitive

Ans. **(d)**

End of Solution

Q.17 Consider a complete binary tree where the left and the right subtrees of the root are max-heaps. The lower bound for the number of operations to convert the tree to a heap is

(a) Ω (logn)
(b) Ω (n)
(c) Ω (nlogn)
(d) Ω (n^2)

Ans. **(a)**

End of Solution

Q.18 The cardinality of the power set of {0, 1, 2 . . ., 10} is _____.

Ans. **(2048)**

End of Solution

Q.19 Match the following:

List-I	**List-II**
A. Lexical analysis	**1.** Graph coloring
B. Parsing	**2.** DFA minimization
C. Register allocation	**3.** Post-order traversal
D. Expression evaluation	**4.** Production tree

Codes:

	A	**B**	**C**	**D**
(a)	2	3	1	4
(b)	2	1	4	3
(c)	2	4	1	3
(d)	2	3	4	1

Ans. **(c)**

End of Solution

Q.20 Identify the correct order in which a server process must invoke the function calls **accept**, **bind**, **listen**, and **recv** according to UNIX socket API.

(a) listen, accept, bind recv
(b) bind, listen, accept, recv
(c) bind, accept, listen, recv
(d) accept, listen, bind, recv

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Ans. **(b)**

End of Solution

Q.21 Consider the following statements:

1. The complement of every Turning decidable language is Turning decidable

2. There exists some language which is in NP but is not Turing decidable

3. If L is a language in NP, L is Turing decidable

Which of the above statements is/are True?

(a) Only 2 (b) Only 3

(c) Only 1 and 2 (d) Only 1 and 3

Ans. **(d)**

End of Solution

Q.22 An unordered list contains n distinct elements. The number of comparisons to find an element in this list that is neither maximum nor minimum is

(a) Θ (nlogn) (b) Θ (n)

(c) Θ (logn) (d) Θ (1)

Ans. **(d)**

End of Solution

Q.23 A system has 6 identical resources and N processes competing for them. Each process can request atmost 2 resources. Which one of the following values of N could lead to a deadlock?

(a) 1 (b) 2

(c) 3 (d) 4

Ans. **(*)**

End of Solution

Q.24 Assume that for a certain processor, a read request takes 50 nanoseconds on a cache miss and 5 nanoseconds on a cache hit. Suppose while running a program, it was observed that 80% of the processor's read requests result in a cache hit. The average read access time in nanoseconds is_____.

Ans. **(14)**

End of Solution

Q.25 A computer system implements a 40 bit virtual address, page size of 8 kilobytes, and a 128-entry translation look-aside buffer (TLB) organized into 32 sets each having four ways. Assume that the TLB tag does not store any process id. The minimum length of the TLB tag in bits is _____.

Ans. **(22)**

End of Solution

Q.26 Let $f(x) = x^{-(1/3)}$ and A denote the area of the region bounded by $f(x)$ and the X-axis, when x varies from –1 to 1. Which of the following statements is/are True?

1. f is continuous in [–1, 1]
2. f is not bounded in [–1, 1]
3. A is nonzero and finite

(a) 2 only
(b) 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

Ans. **(c)**

End of Solution

Q.27 Perform the following operations on the matrix $\begin{bmatrix} 3 & 4 & 45 \\ 7 & 8 & 105 \\ 13 & 2 & 195 \end{bmatrix}$.

1. Add the third row to the second row.
2. Subtract the third column from the first column.

The determinant of the resultant matrix is _____.

Ans. **(0)**

End of Solution

Q.28 A graph is self-complementary if it is isomorphic to its complement. For all self-complementary graphs on n vertices, n is

(a) A multiple of 4
(b) Even
(c) Odd
(d) Congruent to 0 mod 4, or 1 mod 4

Ans. **(d)**

End of Solution

Q.29 Consider the intermediate code given below:

1. i = 1
2. j = 1
3. t1 = 5 * i
4. t2 = t1 + j
5. t3 = 4 * t2
6. t4 = t3
7. a[t4] = –1
8. j = j + 1
9. if j <= 5 goto (3)

10. i = i + 1

11. if i < 5 goto (2)

The number of nodes and edges in the control-flow-graph constructed for the above code, respectively, are

(a) 5 and 7 (b) 6 and 7

(c) 5 and 5 (d) 7 and 8

Ans. **(b)**

End of Solution

Q.30 Consider six memory partitions of size 200 KB, 400 KB, 600 KB, 500 KB, 300 KB, and 250 KB, where KB refers to kilobyte. These partitions need to be allotted to four processes of sizes 357 KB, 210 KB, 468 KB and 491 KB in that order. If the best fit algorithm is used, which partitions are NOT allotted to any process?

(a) 200 KB and 300 KB (b) 200 KB and 250 KB

(c) 250 KB and 300 KB (d) 300 KB and 400 KB

Ans. **(a)**

End of Solution

Q.31 A Young tableau is a 2D array of integers increasing from left to right and from top to bottom. Any unfilled entries are marked with ∞, and hence there cannot be any entry to the right of, or below a ∞. The following Young tableau consists of unique entries.

1	2	5	14
3	4	6	23
10	12	18	25
31	∞	∞	∞

When an element is removed from a Young tableau, other elements should be moved into its place so that the resulting table is still a Young tableau (unfilled entries may be filled in with a ∞). The minimum number of entries (other than 1) to be shifted, to remove 1 from the given Young tableau is _____.

Ans. **(5)**

End of Solution

Q.32 Consider two relations R_1 (A, B) with the tuples (1, 5) and R_1 (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 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

Ans. **(c)**

End of Solution

Q.33 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) $h(i) = (12 * i) \bmod 10$

Ans. **(b)**

End of Solution

Q.34 Assume that the bandwidth for a TCP connection is 1048560 bits/sec. Let α be the value of RTT in milliseconds (rounded off to the nearest integer) after which the TCP window scale option is needed. Let β be the maximum possible window size with window scale option. Then the values of α and β are

(a) 63 milliseconds 65535×2^{14} (b) 63 milliseconds 65535×2^{16}

(c) 500 milliseconds 65535×2^{14} (d) 500 milliseconds 65535×2^{16}

Ans. **(c)**

End of Solution

Q.35 Consider alphabet $\Sigma = \{0, 1\}$, the null/empty string λ and the sets of strings X_0, X_1 and X_2 generated by the corresponding non-terminals of a regular grammar. X_0, X_1 and X_2 are related as follows:

$X_0 = 1X$

$X_1 = 0X_1 + 1X_2$

$X_2 = 0X_1 + \{\lambda\}$

Which one of the following choices precisely represents the strings in X_0?

(a) 10 (0* + (10)*)1 (b) 10 (0* + (10)*)*1

(c) 1 (0* + 10)*1 (d) 10 (0 + 10)*1 + 110 (0 + 10)*1

Ans. **(c)**

End of Solution

Q.36 Given below are some algorithms, and some algorithm design paradigms.

List-I

A. Dijkstra's Shortest Path

B. Floyd-Warshall algorithm to compute all pairs shortest path

C. Binary search on a sorted array

D. Backtracking search on a graph

List-II

1. Divide and Conquer
2. Dynamic Programming
3. Greedy design
4. Depth-first search
5. Breadth-first search

Match the above algorithms on the left to the corresponding design paradigm they follow.

Codes:

	A	B	C	D
(a)	1	3	1	5
(b)	3	3	1	5
(c)	3	2	1	4
(d)	3	2	1	4

Ans. **(c)**

End of Solution

Q.37 The number of min-terms after minimizing the following Boolean expression is _____.

$$[D' + AB' + A'C + AC'D + A'C'D]$$

Ans. **(1)**

End of Solution

Q.38 Consider the C program below.

```
# include <stdio.h>
int *A, stkTop;
int stkFunc (int opcode, int val)
{
        static int size=0, stkTop=0;
        switch (opcode)
        {
                case-1: size = val; break;
                case-0: if (stkTop < size) A[stkTop++] = val; break;
                default: if (stkTop) < return A[- - stkTop];
        }
        return –1;
}
int main( )
{
        int B[20]; A=B; stkTop = –1
        stkFunc (–1, 10);
        stkFunc (0, 5);
```

```
        stkFunc (0, 10);
        printf ("%d\n", stkFunc (1, 0) + stkFunc (0, 0));
}
```

The value printed by the above program is _____.

Ans. **(15)**

End of Solution

Q.39 The secant method is used to find the root of an equation $f(x) = 0$. It is started from two distinct estimates x_a and x_b for the root. It is an iterative procedure involving linear interpolation to a root. The iteration stops if $f(x_b)$ is very small and then x_b is the solution. The procedure is given below. Observe that there is an expression which is missing and is marked by? Which is the suitable expression that is to be put in place of? So that it follows all steps of the secant method?

Secant

```
Initialize: x_a, x_b, ε, N                  // ε = convergence indicator
        f_b = f(x_b)
i = 0
while (i < N and | f_b | > ε) do
i = i + 1                                   // update counter
x_t = ?                                     // missing expression for
                                            // intermediate value
x_a = x_b                                   // reset x_a
x_b = x_t                                   // reset x_b
f_b = f(x_b)                                // function value at new x_b
end while
if | f_b | > ε then                         // loop is terminated with i = N
write "Non-convergence"
else
write "return x_b"
end if
```

(a) $x_b - (f_b - f(x_a))\ f_b / (x_b - x_a)$

(b) $x_a - (f_a - f(x_a))\ f_a / (x_b - x_a)$

(c) $x_b - (f_b - x_a)\ f_b / (x_b - f_b\ (x_a)$

(d) $x_a - (x_b - x_a)\ f_a / (f_b - f\ (x_a))$

Ans. **(c & d)**

End of Solution

Q.40 The number of onto functions (surjective functions) from set X = {1, 2, 3, 4} to set Y = {a, b, c} is _____.

Ans. **(36)**

End of Solution

Q.41 Consider the following routing table at an IP router:

Network No.	Net Mask	Next Hop
128.96.170.0	255.255.254.0	Interface 0
128.96.168.0	255.255.254.0	Interface 1
128.96.166.0	255.255.254.0	R2
128.96.164.0	255.255.254.0	R3
0.0.0.0	Default	R4

For each IP address in Group-I identify the correct choice of the next hop from Group-II using the entries from the routing table above.

List-I	List-II
A. 128.96.171.92	**1.** Interface 0
B. 128.96.167.151	**2.** Interface 1
C. 128.96.163.121	**3.** R2
D. 128.96.165.121	**4.** R3
	5. R4

Codes:

	A	B	C	D
(a)	1	3	5	4
(b)	1	4	2	5
(c)	2	3	4	5
(d)	2	3	5	4

Ans. **(a)**

End of Solution

Q.42 Consider a processor with byte-addressable memory. Assume that all registers, including Program Counter (PC) and Program Status Word (PSW), are of size 2 bytes. A stack in the main memory is implemented from memory location $(0100)_{16}$ and it grows upward. The stack pointer (SP) points to the top element of the stack. The current value of SP is $(016E)_{16}$. The CALL instruction is of two words, the first word is the op-code and the second word is the starting address of the subroutine (one word = 2 bytes). The CALL instruction is implemented as follows:

- Store the current value of PC in the stack.
- Store the value of PSW register in the stack.
- Load the starting address of the subroutine in PC.

The content of PC just before the fetch of a CALL instruction is $(5FA0)_{16}$. After execution of the CALL instruction, the value of the stack pointer is

(a) $(016A)_{16}$ (b) $(016C)_{16}$
(c) $(0170)_{16}$ (d) $(0172)_{16}$

Ans. **(d)**

End of Solution

Q.43 Which one of the following assertions concerning code inspection and code walkthrough is True?

(a) Code inspection is carried out once the code has been unit tested
(b) Code inspection and code walkthrough are synonyms
(c) Adherence to coding standards is checked during code inspection
(d) Code walkthrough is usually carried out by an independent test team

Ans. **(a)**

End of Solution

Q.44 Consider the sequence of machine instructions given below:

```
MUL   R5, R0, R1
DIV   R6, R2, R3
ADD   R7, R5, R6
SUB   R8, R7, R4
```

In the above sequence, R0 to R8 are general purpose registers. In the instructions shown, the first register stores the result of the operation performed on the second and the third registers. This sequence of instructions is to be executed in a pipelined instruction processor with the following 4 stages: (1) Instruction Fetch and Decode (IF), (2) Operand Fetch (OF), (3) Perform Operation (PO) and (4) Write back the Result (WB). The IF, OF and WB stages take 1 clock cycle each for any instruction. The PO stage takes 1 clock cycle for ADD or SUB instruction, 3 clock cycles for MUL instruction and 5 clock cycles for DIV instruction. The pipelined processor uses operand forwarding from the PO stage to the OF stage. The number of clock cycles taken for the execution of the above sequence of instructions is _____.

Ans. **(13)**

End of Solution

Q.45 Suppose you are provided with the following function declaration in the C programming language.

```
int partition (int a[ ], int n);
```

The function treats the first element of a[ ] as a pivot, and rearranges the array so that all elements less than or equal to the pivot is in the left part of the array, and all elements greater than the pivot is in the right part. In addition, it moves the pivot so that the pivot is the last element of the left part. The return value is the number of elements in the left part.

The following partially given function in the C programming language is used to find the k^{th} smallest element in an array a[ ] of size n using the partition function. We assume $k \leq n$.

```
int kth_smallest (int a[ ], int n, int k)
{
    int left_end = partition (a, n);
```

```
        if (left_end+1==k)
        {
                return a [left_end];
        }
        if (left_end+1 > k)
        {
                return kth_smallest (_____________________);
        }
        else
        {
                return kth_smallest (_____________________);
        }
}
```

The missing argument lists are respectively

(a) (a, left_end, k) and (a+left_end+1, n–left_end–1, k–left_end–1)

(b) (a, left_end, k) and (a, n–left_end–1, k–left_end–1)

(c) (a, left_end+1, N–left_end–1, K–left_end–1) and(a, left_end, k)

(d) (a, n–left_end–1, k–left_end–1) and (a, left_end, k)

Ans. **(a)**

End of Solution

Q.46 Consider a simple checkpointing protocol and the following set of operations in the log.

(start, T4); (write, T4, y, 2, 3); (start, T1); (commit, T4); (write, T1, z, 5, 7); (checkpoint);

(start, T2); (write, T2, x, 1, 9); (commit, T2); (start, T3); (write, T3, z, 7, 2);

If a crash happens now and the system tries to recover using both undo and redo operations, what are the contents of the undo list and the redo list

(a) Undo: T3, T1; Redo: T2

(b) Undo: T3, T1; Redo: T2, T4

(c) Undo: none; Redo: T2, T4, T3; T1

(d) Undo: T3, T1, T4; Redo: T2

Ans. **(a)**

End of Solution

Q.47 A Computer system implements 8 kilobyte pages and a 32-bit physical address space. Each page table entry contains a valid bit, a dirty bit three permission bits, and the translation. If the maximum size of the page table of a process is 24 megabytes, the length of the virtual address supported by the system is _____ bits.

Ans. **(36)**

End of Solution

Q.48 A half adder is implemented with XOR and AND gates. A full adder is implemented with two half adders and one OR gate. The propagation delay of an XOR gate is twice that of an AND/OR gate. The propagation delay of an AND/OR gate is 1.2 microseconds. A 4-bit ripple-carry binary adder is implemented by using full adders. The total propagation time of this 4-bit binary adder in microseconds is _____.

Ans. **(19.2)**

End of Solution

Q.49 Consider a typical disk that rotates at 15000 rotations per minute (RPM) and has a transfer rate of 50×10^6 bytes/sec. If the average seek time of the disk is twice the average rotational delay and the controller's transfer time is 10 times the disk transfer time, the average time (in milliseconds) to read or write a 512 byte sector of the disk is _____.

Ans. **(6.1)**

End of Solution

Q.50 In a connected graph, a bridge is an edge whose removal disconnects a graph. Which one of the following statements is True?

(a) A tree has no bridge
(b) A bridge cannot be part of a simple cycle
(c) Every edge of a clique with size ^{3} 3 is a bridge (A clique is any complete subgraph of a graph)
(d) A graph with bridges cannot have a cycle

Ans. **(b)**

End of Solution

Q.51 Which of the following languages is/are regular?

L_1: $\{wxw^R \mid w, x \in \{a, b\}^*$ and $|w|, |x| > 0\}$ w^R is the reverse of string w

L_2: $\{a^n b^m \mid m \neq n$ and $m, n \geq 0$

L_3: $\{a^p b^q c^r \mid p, q, r \geq 0\}$

(a) L_1 and L_3 only
(b) L_2 only
(c) L_2 and L_3 only
(d) L_3 only

Ans. **(a)**

End of Solution

Q.52 Host A sends a UDP datagram containing 8880 bytes of user data to host B over an Ethernet LAN. Ethernet frames may carry data up to 1500 bytes (i.e. MTU = 1500 bytes). Size of UDP header is 8 bytes and size of IP header is 20 bytes. There is no option field in IP header. How may total number of IP fragments will be transmitted and what will be the contents of offset field in the last fragment?

(a) 6 and 925 (b) 6 and 7400

(c) 7 and 1110 (d) 7 and 8880

Ans. **(c)**

End of Solution

Q.53 The number of states in the minimal deterministic finite automaton corresponding to the regular expression (0 + 1)*(10) is _____.

Ans. **(3)**

End of Solution

Q.54 Let X and Y denote the sets containing 2 and 20 distinct objects respectively and F denote the set of all possible functions defined from X and Y. Let f be randomly chosen from F. The probability of f being one-to-one is _____.

Ans. **(0.95)**

End of Solution

Q.55 Which one of the following well formed formulae is a tautology?

(a) $\forall x\, \exists y\, R(x, y) \leftrightarrow \exists y\, \forall x\, R(x, y)$

(b) $(\forall x\, [\exists y\, R(x, y) \rightarrow S(x, y)]) \rightarrow \forall x\, \exists y\, S(x, y)$

(c) $[\forall x\, \exists y\, (P(x, y) \rightarrow R(x, y)] \leftrightarrow [\forall x\, \exists y\, (\neg P(x, y) \vee R(x, y)]$

(d) $\forall x\, \exists y\, P(x, y) \rightarrow \forall x\, \forall y\, P(y, x)$

Ans. **(c)**

End of Solution

■■■■