Andhra Pradesh State Council of Higher Education

Notations :

1.Options shown in green color and with ✔ icon are correct.

2.Options shown in red color and with ✘ icon are incorrect.

Question Paper Name :	Computer Science and Information Technology 18th July 2022 Shift 2
Duration :	120
Total Marks :	120
Display Marks:	No
Share Answer Key With Delivery Engine :	Yes
Calculator :	None
Magnifying Glass Required? :	No
Ruler Required? :	No
Eraser Required? :	No
Scratch Pad Required? :	No
Rough Sketch/Notepad Required? :	No
Protractor Required? :	No
Show Watermark on Console? :	Yes
Highlighter :	No
Auto Save on Console?	Yes
Change Font Color :	No
Change Background Color :	No
Change Theme :	No
Help Button :	No
Show Reports :	No
Show Progress Bar :	No
Is this Group for Examiner? :	No
Examiner permission :	Cant View
Show Progress Bar? :	No

Computer Science and Information Technology

Section Id :	90030010
Section Number :	1
Mandatory or Optional :	Mandatory
Number of Questions :	120
Section Marks :	120
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0

Question Number : 1 Question Id : 9003001081 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How many ways are there to construct a three-letter sequence using the first 7 alphabets respectively

in each of the following cases: (i) with repetition of letters allowed, and (ii) without repetition of letters?

Options :

1. ✓ 343, 210

2. ✗ 210, 343

3. ✗ 343, 343

4. ✗ 210, 210

Question Number : 2 Question Id : 9003001082 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The objective is to assign a random roll number to each of the 'n' students in a class. Assume that the names of the

students in the class are distinct. In how many assignments does the student with the name "Ram" gets the roll number 2?

Options :

1. ✖ n!

2. ✔ (n-1)!

3. ✖ (n-2)!

4. ✖ 1

Question Number : 3 Question Id : 9003001083 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is the correct generating function for the number of integer solutions to

$e_1 + e_2 + e_3 + e_4 = r, 0 \leq e_1 \leq e_2 \leq e_3 \leq e_4$?

Options :

1. ✖ $(1 + x + x^2 + \cdots)$

2. ✖ $(1 + x + x^2 + \cdots)(1 + x^2 + x^4 + \cdots)$

3. ✖ $(1 + x + x^2 + \cdots)(1 + x^2 + x^4 + \cdots)(1 + x^3 + x^6 + \cdots)$

4. ✔ $(1 + x + x^2 + \cdots)(1 + x^2 + x^4 + \cdots)(1 + x^3 + x^6 + \cdots)(1 + x^4 + x^8 + \cdots)$

Question Number : 4 Question Id : 9003001084 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statement(s) is/are true?

(i) The general solution to any inhomogeneous linear recurrence relation is the general solution to the associated homogeneous relation plus one particular in homogenous solution.

(ii) Consider the recurrence relation $a_n = ca_{n-1} + f(n)$. if $f(n)$ is the sum of several different terms, a particular solution for this $f(n)$ may be obtained by summing particular solutions for the individual terms.

Options :

1. ✗ Neither (i) nor (ii)

2. ✗ Only (i)

3. ✗ Only (ii)

4. ✓ Both (i) and (ii)

Question Number : 5 Question Id : 9003001085 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Approximately, what percentage of binary sequences of length 10 consists of a (positive) number of 1s, followed by a number of 0s, followed by a number of 1s, followed by a number of 0s? An example of such a sequence is 1110111000.

Options :

1. ✗ 14%

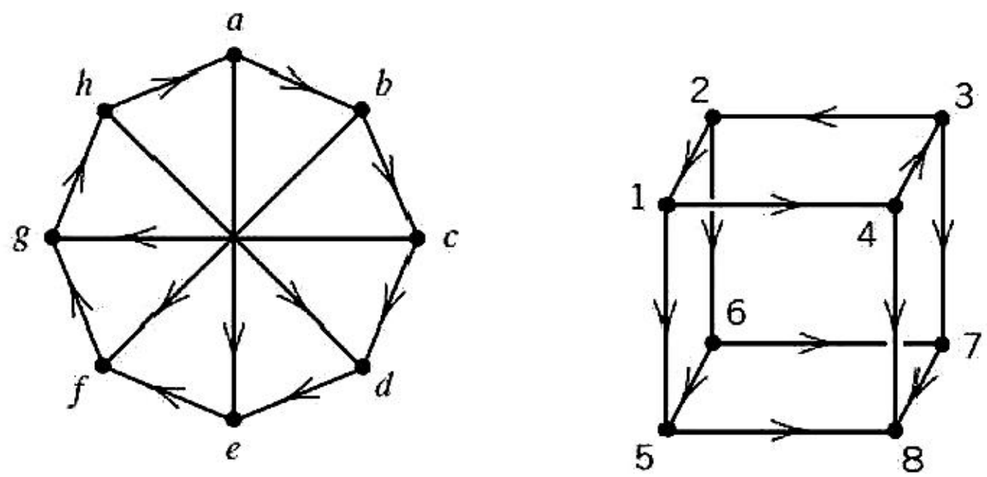
2. ✖ 4%

3. ✔ 8%

4. ✖ 1%

Question Number : 6 Question Id : 9003001086 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statements is / are true regarding the two directed graphs shown in the figure below?



(i) The graphs are isomorphic

(ii) As the graphs are directed, we cannot determine whether the graphs are isomorphic or not.

Options :

1. ✖ Only (i)

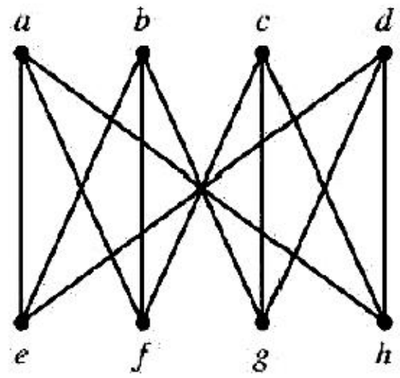
2. ✖ Only (ii)

3. ✔ Neither (i) nor (ii)

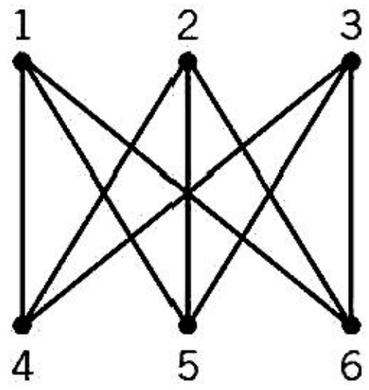
4. ✗ Both (i) and (ii)

Question Number : 7 Question Id : 9003001087 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statement(s) is/are true about the bipartite graphs (a) and (b) shown below?



(a)



(b)

Options :

1. ✓ Only (a) is planar

2. ✗ Only (b) is planar.

3. ✗ Both (a) and (b) are planar

4. ✗ Neither (a) nor (b) are planar

Question Number : 8 Question Id : 9003001088 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What are respectively the minimum and maximum number of Independent sets a graph with

'n' vertices can have? Assume that null set is excluded from consideration.

Options :

1. ✖ $0, n$

2. ✖ $1, n$

3. ✖ $0, 3^n - 1$

4. ✔ $0, 2^n - 1$

Question Number : 9 Question Id : 9003001089 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the minimum number of colors needed for a valid coloring of any planar graph?

Options :

1. ✖ 3

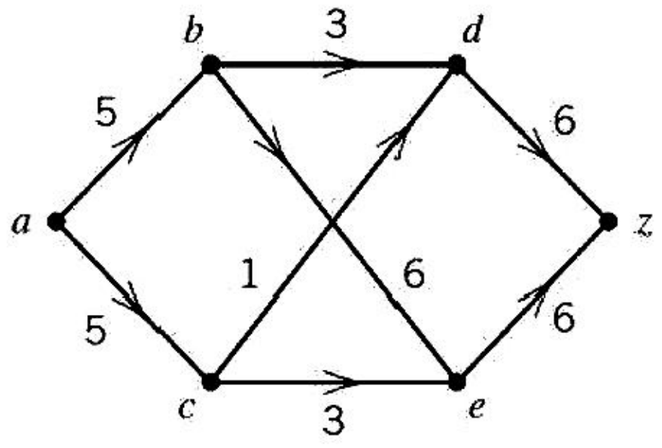
2. ✖ 4

3. ✔ 5

4. ✖ 6

Question Number : 10 Question Id : 9003001090 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the maximum a-z flow in the graph shown below? Each edge weight indicates the capacity of the edge.



Options :

1. ✗ 8

2. ✓ 9

3. ✗ 10

4. ✗ 11

Question Number : 11 Question Id : 9003001091 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the following implication: "If today is Monday then I have APPGCET exam today".

Which of the following statement(s) is / are true?

(i) The contrapositive of the implication is "If I have APPGCET exam today, then today is Monday".

(ii) The converse of the implication is "If I do not have APPGCET exam today then today is not Monday".

Options :

1. ✗ Only (i)

2. ✗ Only (ii)

3. ✓ Neither (i) nor (ii)

4. ✗ Both (i) and (ii)

Question Number : 12 Question Id : 9003001092 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following pairs of propositions is / are logically equivalent?

(i) $\neg(p \wedge q), (\neg p \vee \neg q)$

(ii) $(p \rightarrow q), (\neg p \vee q)$

(iii) $\neg\big(p \vee (\neg p \wedge q)\big), (\neg p \wedge \neg q)$

Options :

1. ✗ Only (i) and (ii)

2. ✗ Only (i) and (iii)

3. ✖ Only (ii) and (iii)

4. ✔ (i), (ii) and (iii)

Question Number : 13 Question Id : 9003001093 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following pair(s) of statements has / have the same truth value?

(i) $\neg\exists x\, \forall y\, P(x,y)$, and $\forall x\, \exists y\, \neg P(x,y)$

(ii) $\exists x\, \big(P(x) \vee Q(x)\big)$, and $\exists x\, P(x) \vee \exists x\, Q(x)$

Options :

1. ✖ Only (i)

2. ✖ Only (ii)

3. ✖ Neither (i) nor (ii)

4. ✔ Both (i) and (ii)

Question Number : 14 Question Id : 9003001094 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following pair(s) of statements is /are not logically equivalent?

(i) $\forall x \left(P(x) \vee Q(x)\right)$, and $\forall x\, P(x) \vee \forall x\, Q(x)$

(ii) $\forall x\, P(x) \vee \forall x\, Q(x)$, and $\forall x\, \forall y \left(P(x) \vee Q(y)\right)$

Options :

1. ✔ Only (i)

2. ✘ Only (ii)

3. ✘ Neither (i) nor (ii)

4. ✘ Both (i) and (ii)

Question Number : 15 Question Id : 9003001095 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following label(s) apply / applies to the statement $(p \wedge q) \rightarrow (p \vee q)$?

(i) Satisfiable

(ii) Contradiction

(iii) Not Satisfiable

(iv) Tautology

Options :

1. ✔ Only (i) and (iv)

2. ✗ Only (iii)

3. ✗ Only (ii) and (iii)

4. ✗ Only (i)

Question Number : 16 Question Id : 9003001096 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the number of bits needed to represent decimal values ranging from 0 to 12,500?

Options :

1. ✗ 11

2. ✗ 12

3. ✗ 13

4. ✓ 14

Question Number : 17 Question Id : 9003001097 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the radix 10 equivalent of $B2F_{16}$?

Options :

1. ✗ 2861

2. ✗ 2862

3. ✓ 2863

4. ✖ 2864

Question Number : 18 Question Id : 9003001098 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is the simplified form of the Boolean expression

$z = \bar{A}C\overline{(\bar{A}BD)} + \bar{A}B\bar{C}\bar{D} + A\bar{B}C$?

Options :

1. ✖ $\bar{B}C$

2. ✖ $\bar{B}C + \bar{A}\bar{D}B$

3. ✖ $\bar{A}\bar{D}B + \bar{A}\bar{D}C$

4. ✔ $\bar{B}C + \bar{A}\bar{D}B + \bar{A}\bar{D}C$

Question Number : 19 Question Id : 9003001099 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a logic circuit that has three inputs A, B and C, whose output will be high only when a majority of the inputs are high. In this circuit, what are respectively the minimum number of two-input AND gates and three-input OR gates required to implement the functionality of the circuit correctly?

Options :

1. ✖ 2 and 2

2. ✖ 3 and 2

3. ✔ 3 and 1

4. ✖ 4 and 1

Question Number : 20 Question Id : 9003001100 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A counter is needed that will count the number of items passing on a conveyor belt. A photocell and light source combination is used to generate a single pulse each time an item crosses its path. The counter must be able to count as many as one thousand and twenty-four items. How many Flip-Flops are required?

Options :

1. ✖ 8

2. ✖ 9

3. ✖ 10

4. ✔ 11

Question Number : 21 Question Id : 9003001101 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How many half-adders are required to implement a 4-bit binary incrementer circuit?

Options :

1. ✖ 2

2. ✓ 4

3. ✗ 5

4. ✗ 8

Question Number : 22 Question Id : 9003001102 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which microoperation can be used to implement the selective-set operation which is

described below?

The selective-set operation sets to 1 the bits in register A where there are corresponding 1's

in register B. It does not affect bit positions that have 0's in B.

Options :

1. ✓ OR

2. ✗ AND

3. ✗ XOR

4. ✗ NOR

Question Number : 23 Question Id : 9003001103 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A computer uses a memory unit with 256K words of 32 bits each. A binary instruction code is stored

in one word of memory. The instruction has four parts: an indirect bit, an operation code, a register code

to specify one of the 64 registers, and an address part. How many bits are there in the operation code?

Options :

1. ✖ 5

2. ✖ 6

3. ✔ 7

4. ✖ 8

Question Number : 24 Question Id : 9003001104 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How many references to memory are needed respectively for a direct and an indirect address instruction to bring an operand into a processor register?

Options :

1. ✖ 1, 2

2. ✔ 2, 3

3. ✖ 3, 4

4. ✖ 2, 2

Question Number : 25 Question Id : 9003001105 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statement(s) is / are true?

(i) A microprogrammed computer is necessarily a microprocessor.

(ii) Hardwired control unit contains a control memory.

Options :

1. ✗ Only (i)

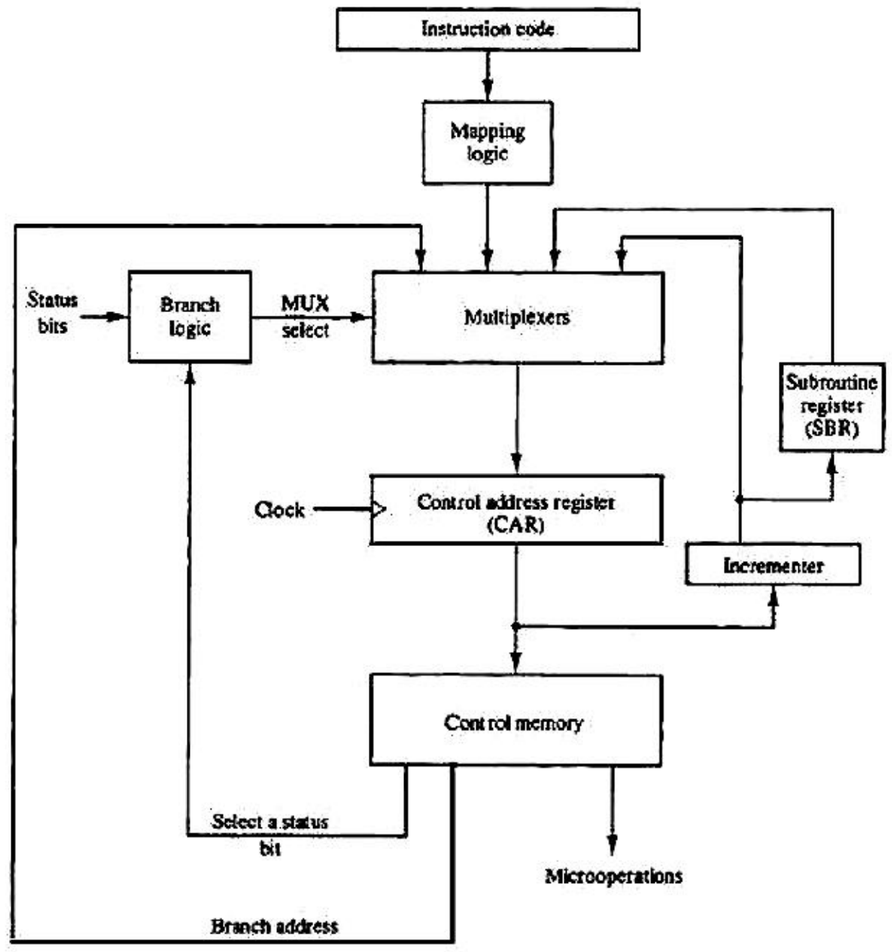
2. ✗ Only (ii)

3. ✓ Neither (i) nor (ii)

4. ✗ Both (i) and (ii)

Question Number : 26 Question Id : 9003001106 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The following figure illustrates the selection of address for control memory.



The control memory has 4096 words of 24 bits each. How many bits are there in the control address register (CAR)?

Options :

1. ✖ 10

2. ✖ 11

3. ✔ 12

4. ✗ 13

Question Number : 27 Question Id : 9003001107 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The task is to divide a 9-bit microoperation field in a microinstruction into subfields F1 and F2 each with B1 and B2 bits respectively so that the microinstruction can specify 46 microoperations. What are the sizes of the sub-fields B1 and B2 respectively?

Options :

1. ✗ 3, 6

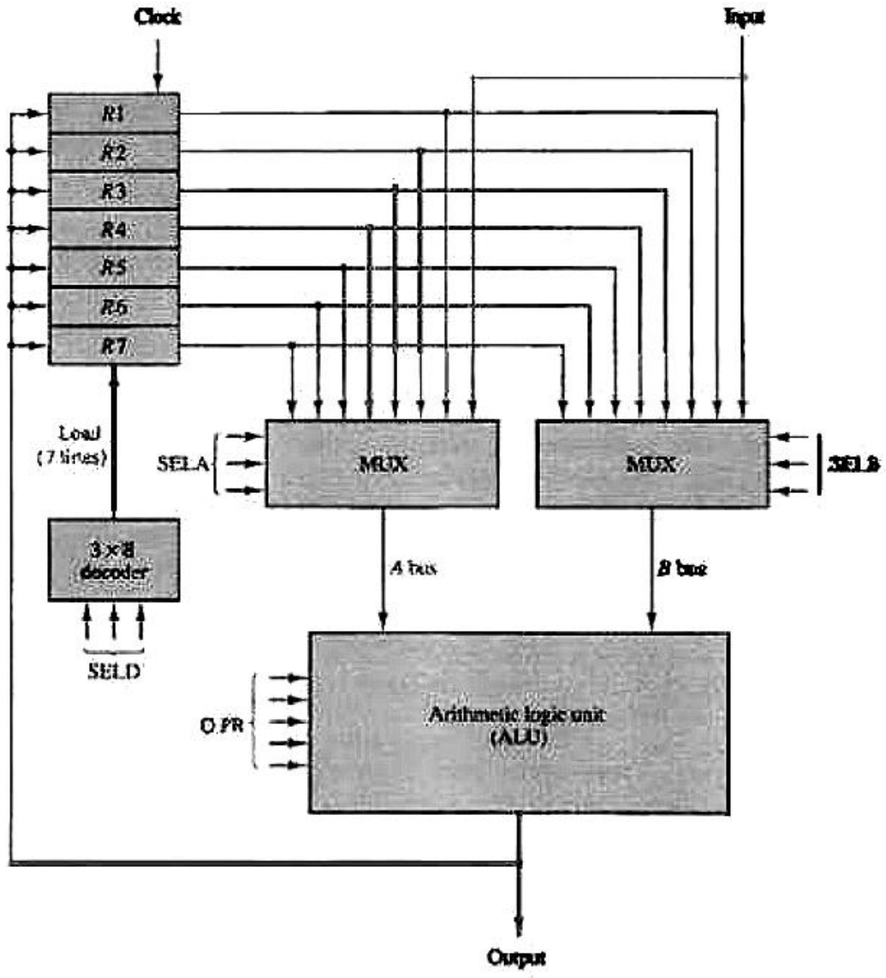
2. ✗ 2, 7

3. ✓ 5, 4

4. ✗ 1, 8

Question Number : 28 Question Id : 9003001108 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A bus organized CPU similar to the one shown in the Figure below has 16 registers with 32 bits each, an ALU and a destination decoder. How many multiplexers are there in the Bus A and what is the size of each multiplexer?



Options :

1. ✓ 32 multiplexers each of size 16 x 1

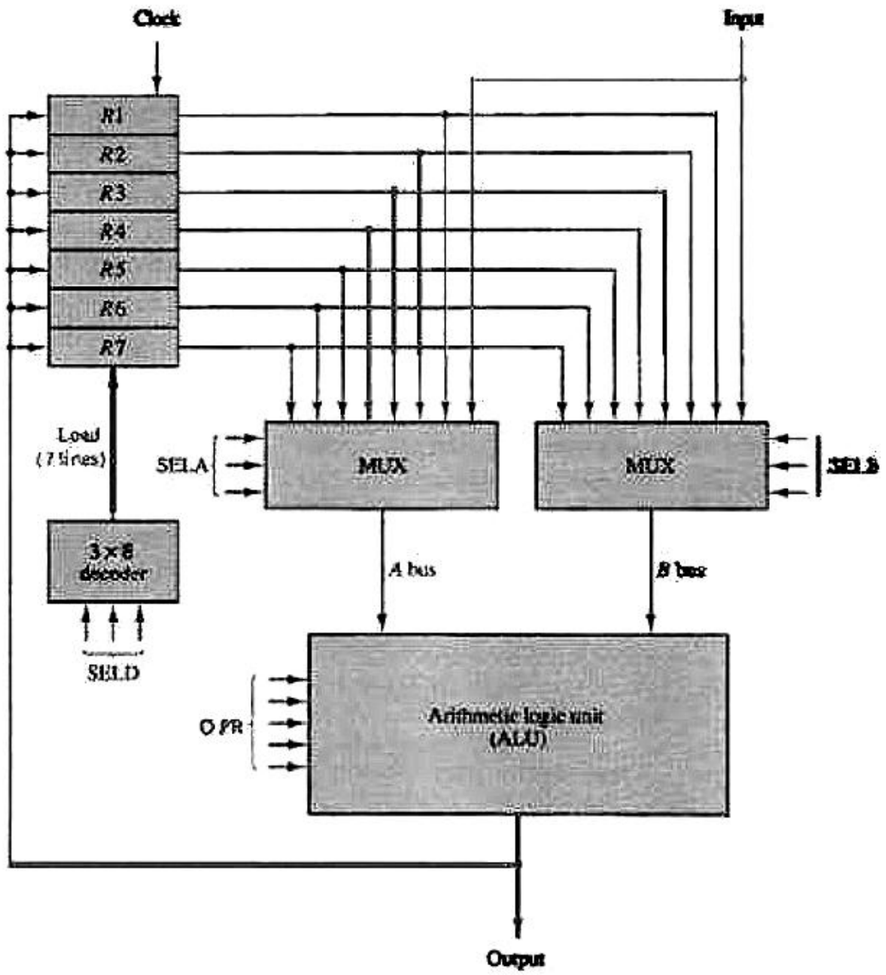
2. ✗ 16 multiplexers each of size 16 x 1

3. ✖ 16 multiplexers each of size 8 x 1

4. ✖ 8 multiplexers each of size 4 x 1

Question Number : 29 Question Id : 9003001109 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The bus organized CPU shown in the following figure has the following propagation delay times: 30 ns for the signals to propagate through the multiplexers, 80ns to perform the ADD operation in the ALU, 20 ns delay in the destination decoder, and 10 ns to clock the data into the destination register. What is the minimum cycle time that can be used for the clock?



Options :

1. ✓ 120 ns

2. ✗ 140 ns

3. ✗ 160 ns

4. ✗ 280 ns

Question Number : 30 Question Id : 9003001110 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A non-pipeline system takes 50 ns to process a task. The same task can be processed in a six-segment pipeline with a clock cycle of 10 ns. What is the speed-up ratio of the pipeline for 100 tasks?

Options :

1. ✗ 4.06

2. ✗ 4.56

3. ✓ 4.76

4. ✗ 5.06

Question Number : 31 Question Id : 9003001111 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statement(s) is / are true about the symbolic constant EOF in C programming language?

(i) Irrespective of the system on which a program is run the value of EOF is -1.

(ii) Symbolic constants like EOF help render the C program portable.

(iii) EOF is defined in stdlib.h

Options :

1. ✖ Only (i)

2. ✖ Only (i) and (ii)

3. ✔ Only (ii)

4. ✖ Only (ii) and (iii)

Question Number : 32 Question Id : 9003001112 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the behavior of the following C program?

```
#include <stdio.h>
# define NONBLANK 'a'
main() {
   int c, lastc ;
   lastc = NONBLANK;
   while ((c = get char()) != EOF) {
            if ( c != ' ')
                     putchar(c);
            if (c == ' ')
                     if (lastc != ' ')
                              putchar(c);
            lastc = c;
      }
   }
```

Options :

1. ✗ The program as such copies its input to its output after removing the blanks.

2. ✓ The program copies its input to its output after replacing a string of blanks with a single blank.

3. ✗ Compilation error

4. ✗ Runtime error

Question Number : 33 Question Id : 9003001113 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the correct behavior of the following function?

```
void test(char s[]) {
  int i, j;
  char temp;
  i =0;
  while(s[i] != '\0')
        ++i;
  --i;
  if(s[i] == '\n')
        --i;
  j = 0;
  while(j < i) {
        temp = s[j];
        s[j] = s[i];
        s[i] = temp;
        --i;
        ++j;
    }
  }
```

Options :

1. ✗ Sorts the characters of the string in the ascending lexicographic order.

2. ✗ Sorts the characters of the string in the descending lexicographic order.

3. ✓ Reverses the string.

4. ✗ Compile / runtime error.

Question Number : 34 Question Id : 9003001114 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the output of the C expression (char)((unsigned char) ~ 0 >> 1) ?

Options :

1. ✗ binary representation of zero, right-shifted by one position.

2. ✗ binary representation of one, right-shifted by one position.

3. ✓ Maximum value of a signed-character.

4. ✗ Maximum value of an unsigned-character.

Question Number : 35 Question Id : 9003001115 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the behavior of the following C code snippet?

```
void fun(char s1[], char s2[]) {
 int i, j, k;
 for(i = k = 0; s1[i] != '\0'; i++) {
        for(j=0; s2[j] != '\0' && s2[j] != s1[i] ; j++);
        if(s2[j] == '\0')
              s1[k++] = s1[i];
 }
      s1[k] = '\0';
 }
```

Options :

1. ✓ Deletes each character in s1 which is in s2.

2. ✗ Deletes each character in s1 which is not in s2.

3. ✗ Compile time error.

4. ✗ run-time error.

Question Number : 36 Question Id : 9003001116 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is the correct behavior of the code-snippet shown below?

```
unsigned manipulateBits(unsigned x, int p, int n, unsigned y) {
  return x & ~(~(~0 << n) << (p+1-n)) |
         (y & ~(~0 << n)) << (p+1-n) ;
  }
```

Options :

1. ✗ Returns the bitwise OR of x and y left shifted by p+1-n positions.

2. ✗ Returns the bitwise OR of x and y after masking certain bits of x and y.

3. ✓ Returns x after setting the n bits of x at position p to the rightmost n bits of y.

4. ✗ Compilation error.

Question Number : 37 Question Id : 9003001117 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following string functions is being performed by the function below?

```
void unidentified(char *s, char *t) {
  while(*s)
        s++;
  while(*s++ = *t++);
  }
```

Options :

1. ✖ String compare

2. ✖ String copy

3. ✖ String reverse

4. ✔ String concatenation

Question Number : 38 Question Id : 9003001118 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the output of the function printd, when the integer 345 is passed as the parameter?

```
#include <stdio.h>
void printd(int n) {
    if (n < 0) {
        putchar('-');
        n = -n;
    }
    if (n / 10)
        printd(n / 10);
    putchar(n % 10 + '0');
    }
```

Options :

1. ✖ 543

2. ✔ 345

3. ✗ 000

4. ✗ 54

Question Number : 39 Question Id : 9003001119 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let A[] be an array in C. Let p = &a[0]. Then which of the following reference is correct to denote A[i]?

Options :

1. ✗ *p[i]

2. ✓ *(p+i)

3. ✗ &(p+i)

4. ✗ **(p+i)

Question Number : 40 Question Id : 9003001120 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is the correct way to denote a pointer to a function that has two void * arguments and returns an int?

Options :

1. ✓ int (*comp)(void *, void *)

2. ✗ int (comp*)(void*, void*)

3. ✗ int (comp)(fp*)(void *, void*)

4. ✗ int (**comp)(void*, void*)

Question Number : 41 Question Id : 9003001121 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statement(s) is / are true?

(i) For any two asymptotically non-negative functions f(n) and g(n), $\max(f(n), g(n)) = \theta(f(n) + g(n))$.

(ii) $o(g(n)) \cap \omega(g(n)) \neq \Phi$, where 'o' is the small-Oh notation and g(n) is any asymptotically non-negative function.

Options :

1. ✓ Only (i)

2. ✗ Only (ii)

3. ✗ Neither (i) nor (ii)

4. ✗ Both (i) and (ii)

Question Number : 42 Question Id : 9003001122 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Given an array of 'n' integers may comprise both positive and negative integers, we wish to find the contiguous sub-array containing the maximum sum. What is the worst-case time-complexity of the most efficient divide and conquer algorithm to solve this problem?

Options :

1. ✖ O(log n)

2. ✔ O(n log n)

3. ✖ $O(n^2)$

4. ✖ $O(n^2 \log n)$

Question Number : 43 Question Id : 9003001123 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

While analyzing the Strassen's matrix multiplication algorithm, which of the following is the correct recurrence obtained?

Options :

1. ✖ $T(n) = 8T\left(\frac{n}{2}\right) + O(n^2)$

2. ✖ $T(n) = 8T\left(\frac{n}{2}\right) + O(n)$

3. ✔ $T(n) = 7T\left(\frac{n}{2}\right) + O(n^2)$

4. ✖ $T(n) = 7T\left(\frac{n}{2}\right) + O(n)$

Question Number : 44 Question Id : 9003001124 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the correct closed form solution to the following recurrence?

$$T(n) = 2T(\sqrt{n}) + \log_2 n$$

Options :

1. ✗ $O(\log_2 n)$

2. ✗ $O((\log_2 n)^2)$

3. ✓ $O(\log_2 n \log_2(\log_2 n))$

4. ✗ $O(\log_2(\log_2 n))$

Question Number : 45 Question Id : 9003001125 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

While running the Heapsort algorithm, which of the following is the worst-case running time of the Heapify operation when run on a Heap of size 'n'?

Options :

1. ✓ $\Omega(\log_2 n)$

2. ✗ $\Omega(n)$

3. ✗ $\Omega(nlog_2 n)$

4. ✖ $\Omega(n^2)$

Question Number : 46 Question Id : 9003001126 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is the worst-case running time of the quicksort algorithm?

Options :

1. ✖ $O(nlog_2 n)$

2. ✔ $O(n^2)$

3. ✖ $O(n^2 \log_2 n)$

4. ✖ $O(n)$

Question Number : 47 Question Id : 9003001127 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following problems does not exhibit the optimal substructure property?

Options :

1. ✖ 0/1 Knapsack problem

2. ✖ Finding all-pair shortest paths in a weighted directed graph

3. ✖ Finding the computationally cheapest way of multiplying a chain of matrices.

4. ✔ Finding the longest path between a given pair of vertices in a weighted directed graph.

Question Number : 48 Question Id : 9003001128 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the problem of computing the value of ${}^{n}C_{k}$ the number of ways of selecting k items out of n items. Which of the following statement(s) is / are true about this problem?

(i) The divide-and-conquer approach if applied to this problem will result in overlapping sub-problems.

(ii) The problem if solved using a dynamic programming algorithm requires a space-complexity of O(k) for the memorization table.

Options :

1. ✗ Only (i)

2. ✗ Only (ii)

3. ✗ Neither (i) nor (ii)

4. ✓ Both (i) and (ii)

Question Number : 49 Question Id : 9003001129 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is the time-complexity for performing the Breadth First Search operation on a directed graph G(V, E) (where, V: vertex set and E: Edge set) with an adjacency list representation?

Options :

1. ✓ $O(|V| + |E|)$

2. ✗ $O(|V||E|)$

3. ✖ $O(|V|^2)$

4. ✖ $O(|E|^2)$

Question Number : 50 Question Id : 9003001130 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statement(s) is /are true about the Minimum Spanning Tree construction algorithms?

(i) Prim's is a greedy algorithm whereas Kruskal's is based on dynamic programming

(ii) Both Prim's and Kruskal's grows the Minimum Spanning Tree as a single Tree and not as a forest of trees.

(iii) Fibonacci Heap is effective in speeding-up Prim's algorithm.

(iv) Disjoint sets are useful in implementing Kruskal's algorithm.

Options :

1. ✖ Only (i) and (ii)

2. ✖ Only (ii) and (iii)

3. ✔ Only (iii) and (iv)

4. ✖ Only (ii) and (iv)

Question Number : 51 Question Id : 9003001131 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Given $h(n) \in O(n)$ and an integer k, which of the following statements is true?

Options :

1. ✗ $k^{h(n)} \in O(k^n)$

2. ✗ $k^{h(n)} \notin O(k^n)$

3. ✓ $k^{h(n)} \in O(k^n)$ does not necessarily be a consequent of the given antecedent.

4. ✗ $k^{h(n)}$ *and* $O(k^n)$ are not asymptotically comparable

Question Number : 52 Question Id : 9003001132 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $p(n) = 27n^2 + 3.14n + 12$. To prove that $p(n) = O(n^2)$, assuming $n_0 = 1$, what is the minimum value for c?

Options :

1. ✓ 42.14

2. ✗ 42.00

3. ✗ 43.00

4. ✗ 42.50

Question Number : 53 Question Id : 9003001133 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the time complexity of the following code snippet?

```
function test(int p, int q, int r) {
  if(p>0) {
        test(p-1, q, 6-q-r);
        test(p-1, 6-q-r, r);
    }
  }
```

Options :

1. ✖ 2^p

2. ✖ $2^{(p+1)}$

3. ✔ $2^p - 1$

4. ✖ $2^{(p-1)}$

Question Number : 54 Question Id : 9003001134 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the asymptotic complexity of an algorithm whose time complexity is described through the recurrence P with two inputs of equal size?

$$P(a,b) = Q(a,b/2) + \theta(a)$$

$$Q(a,b) = P(a/2,b) + \theta(b)$$

Options :

1. ✔ $Linear$

2. ✖ quadratic

3. ✖ Log linear

4. ✖ Logarithmic

Question Number : 55 Question Id : 9003001135 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Infer the true statement about the three divide-and-conquer algorithms mentioned in the table below.

Algorithm	Time	Rate of proliferation	Rate of work shrinkage	Time for splitting and combining
A1	T1(n)	7	7	linear
A2	T2(n)	16	4	constant
A3	T3(n)	2	2	quadratic

Options :

1. ✖ $T1(n) < T2(n) < T3(n)$

2. ✖ $T2(n) < T1(n) < T3(n)$

3. ✔ $T1(n) < T2(n) <= T3(n)$

4. ✖ $T1(n) = T2(n) = T3(n)$

Question Number : 56 Question Id : 9003001136 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response

Time : N.A Think Time : N.A Minimum Instruction Time : 0

Infer which of the following statement(s) is/are true.

```
int mystery(int arr[], int ℓ, int r) {
    if(ℓ > r)
            return l;
    q = ℓ + (r- ℓ)/2;
    if(arr[q] == q)
            return mystery(arr, q+1, r);
    else
            return mystery(arr, ℓ, q-1);
    }
```

(i) This algorithm works only if the array contains distinct elements.

(ii) This algorithm runs in O(n) time.

(iii) This algorithm finds a number that is related in some way to the other numbers present in the array.

(iv) The algorithm runs in o(log n) time.

Options :

1. ✖ (i) only

2. ✔ (i), (ii) and (iii) only

3. ✖ (i), (iii) and (iv) only

4. ✖ (i) and (iv) only

Question Number : 57 Question Id : 9003001137 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Assume that there are 11 activities whose start and finish [s, f) times in the half-open interval are as given in the table below. The objective is to schedule as many activities as possible whose intervals are non-overlapping. If you adopt a greedy strategy to find the maximum cardinality set of activities that can be scheduled without any clashes in their intervals, then infer which of the following statement(s) is/are true.

Activity	1	2	3	4	5	6	7	8	9	10	11
Start	7	5	7	2	5	3	14	4	10	10	8
Finish	11	11	9	8	7	6	16	15	14	13	12

(i) The size of the optimal answer is 4.

(ii) There are multiple optimal answers possible for this instance.

(iii) An optimal answer is {4, 9, 2, 7}.

(iv) This problem obeys the optimal substructure property.

Options :

1. ✖ (i) and (iii) only

2. ✖ (i) and (ii) only

3. ✖ (ii) and (iv) only

4. ✔ (i), (ii) and (iv) only

Question Number : 58 Question Id : 9003001138 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In order to assemble a genome, it is necessary to combine snippets from many reads into a single sequence. The input is a set of n genome snippets, each of which is a string of up to k symbols. The output is the smallest single string that contains all of the input snippets as substrings. For example, if the input is {ACCAGAATACC, TCCAGAATAA, TACCCGTGATCCA}, the output should be ACCAGAATACCCGTGATCCAGAATAA.

Infer which of the following statement(s) is / are true about this genome assembly problem.

(i) This problem is in NP.

(ii) This problem is in NP-Hard.

Options :

1. ✖ Only (i)

2. ✖ Only (ii)

3. ✖ Neither (i) nor (ii)

4. ✔ Both (i) and (ii)

Question Number : 59 Question Id : 9003001139 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let HAMD be the problem of deciding whether there is a Hamiltonian cycle in a given graph. Let HAM be the problem of finding the Hamiltonian cycle in a given graph.

Which of the following statement(s) is / are true?

(i) HAMD is poly-time Turing reducible to HAM.

(ii) HAM is poly-time Turing reducible to HAMD.

(iii) HAM and HAMD are not poly-time Turing equivalent problems.

Options :

1. ✗ Only (i).

2. ✓ Only (i) and (ii).

3. ✗ Only (i) and (iii).

4. ✗ Only (ii) and (iii).

Question Number : 60 Question Id : 9003001140 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Infer which of the following statement(s) is / are false?

(i) SAT-CNF is in NP-complete.

(ii) SAT is not in NP-complete.

(iii) Given a graph, deciding whether the graph can be painted with 3 colors is not in NP- complete.

Options :

1. ✗ only (i).

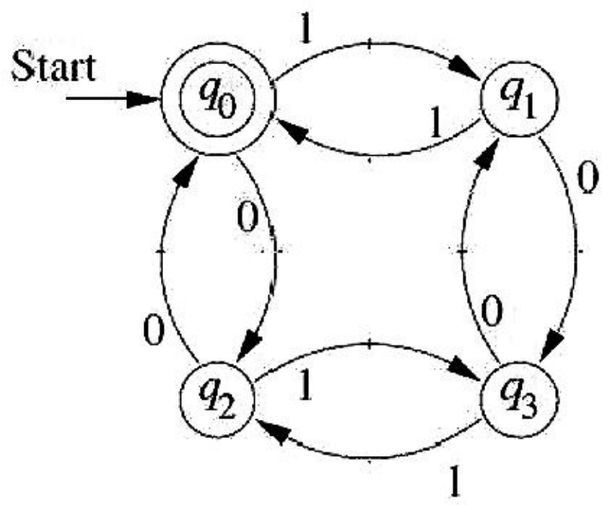
2. ✗ only (ii).

3. ✗ only (i) and (iii).

4. ✓ only (ii) and (iii).

Question Number : 61 Question Id : 9003001141 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the language accepted by the following Deterministic Finite Automaton?



Options :

1. ✗ Strings containing an equal number of 0's and 1's.

2. ✗ Strings containing even number of 0's and odd number of 1's.

3. ✗ Strings containing odd number of 0's and even number of 1's.

4. ✓ Strings containing an even number of 0's and an even number of 1's.

Question Number : 62 Question Id : 9003001142 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $A = \{Q, \Sigma, \delta, q_0, \{q_f\}\}$ be a Deterministic Finite Automaton, with Q as the set of states, Σ as the alphabet set, δ as the transition function, q_0 as the start state and q_f as the final state. Also, let $\forall a \in \Sigma, \delta(q_0, a) = \delta(q_f, a)$.

Infer which of the following statement(s) is / are true?

(i) $\forall w \in \Sigma^*$ and $w \neq \epsilon$, $\hat{\delta}(q_0, w) = \hat{\delta}(q_f, w)$, where $\hat{\delta}$ is the extended transition function of the DFA when we execute the DFA on the string w.

(ii) If x is a non-empty string in L(A), then for all $k > 0$, x^k, is also in L(A).

Options :

1. ✗ only (i).

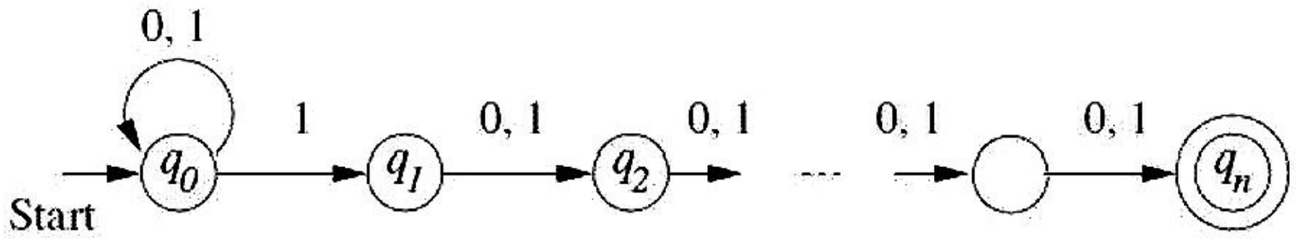
2. ✗ only (ii).

3. ✗ neither (i) nor (ii).

4. ✓ both (i) and (ii).

Question Number : 63 Question Id : 9003001143 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The Non-Deterministic Finite Automata (A) shown below has an equivalent Deterministic Finite Automaton (B). What can be inferred about the number of states in the DFA B?



Options :

1. ✗ B has atleast n states.

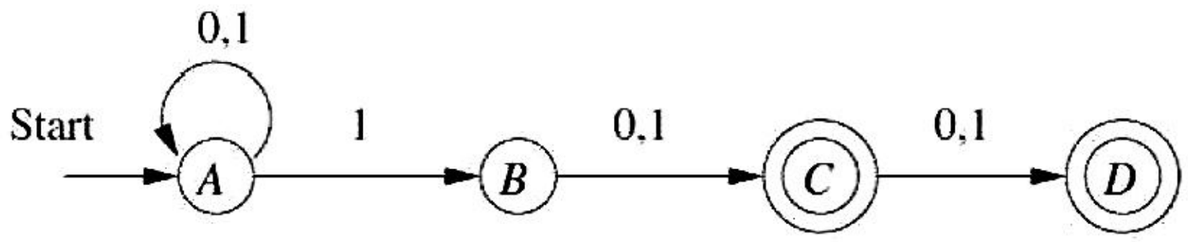
2. ✗ B has atleast n^2 states.

3. ✗ B has atleast n^3 states.

4. ✓ B has atleast 2^n states.

Question Number : 64 Question Id : 9003001144 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is the correct regular expression corresponding to the NFA shown below?



Options :

1. ✗ $(0+1)^*1(0+1)$

2. ✗ $(0+1)^*1(0+1)(0+1)$

3. ✓ $(0+1)^*1(0+1)+(0+1)^*1(0+1)(0+1)$

4. ✗ $(0+1)^*1(0+1)^*$

Question Number : 65 Question Id : 9003001145 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following language(s) is / are not regular?

(i) $\{0^n1^n \mid n \geq 1\}$

(ii) $\{0^n10^n \mid n \geq 1\}$

(iii) $\{0^n \mid n \text{ is a power of } 2\}$

(iv) Any finite set of binary strings.

Options :

1. ✗ Only (i).

2. ✗ Only (i) and (ii).

3. ✓ Only (i), (ii) and (iii).

4. ✗ Only (iii) and (iv).

Question Number : 66 Question Id : 9003001146 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If L is a regular language, then which of the following statements is true regarding the closure properties of L?

Options :

1. ✓ L is closed under union, intersection and complementation.

2. ✗ L is closed under union and intersection but not under complementation.

3. ✗ L is closed under homomorphisms but not under inverse homomorphisms.

4. ✗ L is closed under union but not intersection and complementation.

Question Number : 67 Question Id : 9003001147 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Infer which of the following statement(s) is / are true?

(i) If L = L(P) for some Deterministic Push Down Automaton P, then L has an ambiguous Context Free Grammar.

(ii) If N(A) represents the set of all strings accepted by Null store by the Push Down Automaton A, then irrespective of the number of states in A, there exists a one-state PDA B such that N(A) = N(B).

Options :

1. ✗ Only (i).

2. ✓ Only (ii).

3. ✗ Neither (i) nor (ii).

4. ✗ Both (i) and (ii).

Question Number : 68 Question Id : 9003001148 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following languages are not context-free?

(i) Any finite set of binary strings.

(ii) $\{a^i b^j c^k | i < j < k\}$

(iii) $\{0^n 1^n | n \geq 1\}$

(iv) $\{0^i 1^j | j = i^2\}$

Options :

1. ✗ Only (i) and (iii).

2. ✗ Only (ii).

3. ✓ Only (ii) and (iv).

4. ✗ Only (ii), (iii) and (iv).

Question Number : 69 Question Id : 9003001149 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statements is true?

Options :

1. ✗ Every language accepted by a multi-tape Turing Machine need not necessarily be recursively enumerable.

2. ✗ A language L is recursive if L is the set of strings accepted by some Turing Machine.

3. ✗ Recursive Languages are closed under union but not intersection.

4. ✓ A Language L is recursive if and only if both L and its complement are Recursively Enumerable.

Question Number : 70 Question Id : 9003001150 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statements is true?

Options :

1. ✓ If A is a non-deterministic Turing Machine then there exists a deterministic Turing Machine such that L(A) = L(B).

2. ✗ Every language accepted by a TM A cannot be accepted by a TM B with the following restrictions: (i) B's head never moves left of its initial position, (ii) B never writes a blank.

3. ✗ The diagonalization language is recursively enumerable.

4. ✗ The halting problem in which the set of (M, w) pairs such that the Turing Machine M halts with or without accepting, when given input w is recursive but not recursively enumerable.

Question Number : 71 Question Id : 9003001151 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the following CFG:

G: $S \rightarrow S$ '|' S

$S \rightarrow S\ S$

$S \rightarrow S *$

$S \rightarrow (S)$

$S \rightarrow y \mid x$

Note that '|' denotes the terminal symbol |.

i) The first set of S includes x and y

ii) The follow set of S includes x and y

iii) The follow set of S includes all the terminals generated by G

iv) $FIRST(S) \supseteq FOLLOW(S)$

Infer which of the following is true:

Options :

1. ✗ Only (i) and (ii)

2. ✗ Only (ii) and (iii)

3. ✗ Only (ii), (iii) and (iv)

4. ✓ Only (i), (ii), and (iii)

Question Number : 72 Question Id : 9003001152 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the minimum number of lookaheads required to parse sentences generated by the following grammar ?

$S \rightarrow Xab$

$S \rightarrow Yac$

$X \rightarrow x$

$Y \rightarrow x$

Options :

1. ✖ 1

2. ✔ 2

3. ✖ 3

4. ✖ 4

Question Number : 73 Question Id : 9003001153 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For the CFG

$S \rightarrow X \mid 01$

$X \rightarrow 2X1 \mid Y$

$Y \rightarrow 0$

What is the cardinality of the set of LR(1) items?

Options :

1. ✖ 12

2. ✖ 13

3. ✓ 14

4. ✗ 15

Question Number : 74 Question Id : 9003001154 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Infer the statement that may have generated the TAC below, assuming that row-major order

storage is adopted by the runtime environment.

t1 = a x 1024

t2 = b x 32

t3 = c x 4

t4 = t1 + t2

t5 = t3 + t4

t6 = A[t5]

Options :

1. ✗ int A[4][32][8]

2. ✗ int A[32][16][2]

3. ✗ int A[8][32][32]

4. ✓ int A[32][32][8]

Question Number : 75 Question Id : 9003001155 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response

Time : N.A Think Time : N.A Minimum Instruction Time : 0

Infer which of the following statement(s) is/are true about the following code snippet:

```
Program Test {
    int i;
    procedure p1() {
            print (i);
    }
    procedure p2() {
            int i;
            i = 2;
            p1();
     }
     i = 1;
      p1();
      p2();
    }
```

i) The output of the program is not affected by whether the scoping is lexical or dynamic.

ii) The maximum level of depth a function activation must search for a non-local name, in case the access and control links point to the same activation records, can't be predetermined at compile time.

iii) For this program, dynamic scoping does not require both access and control links in the activation frame to be maintained.

iv) For this example, displays cannot be used for implementing dynamic scoping

mechanism.

Options :

1. ✗ Only (i)

2. ✗ Only (ii) and (iii)

3. ✓ Only (ii), (iii) and (iv)

4. ✗ Only (ii) and (iv)

Question Number : 76 Question Id : 9003001156 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statement(s) is/are not true with respect to runtime memory management?

(i) If the symbol table is implemented as a set of hash tables, then two pieces of information one related to the bucket in which an entry falls, and another related to the scope of the entry must be maintained.

(ii) Garbage collection by Mark and sweep techniques are cheaper to execute than reference counting; however less effective in dealing with memory leaks.

(iii) If a function pointer can be returned by another function then such a scenario can be handled using activation frames implemented using a stack.

Options :

1. ✗ (i) only

2. ✖ (ii) only

3. ✖ (i) and (ii) only

4. ✔ (i), (ii) and (iii)

Question Number : 77 Question Id : 9003001157 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the flow graph implied by the following code snippet:

```
while(t2) {
    t1 = t2 + t3;
    t4 = t4 * t2;
    t5 = t1/t6;
    if(t5) {
        t2 = t6 * t4;
        t5 = t3 + t1;
        if(t2)
            Call Function1(t2,t4,t5,t6); //Assume control goes out of the loop
  } else {
        t6 = t1 * t4;
    }
    t2 = t4 – t3;
  }
  print(t2, t3, t4, t5, t6);
```

Which two variables are more likely to be stored in registers at the end of a Usage and live analysis of the flow graph?

Options :

1. ✖ t1 and t4

2. ✖ t3 and t2

3. ✓ t4 and t2

4. ✗ t1 and t2

Question Number : 78 Question Id : 9003001158 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the function fun(int) as shown below. In a call tree generated by a sequence of function calls initiated by a call to fun(5), the sequence of calls and unwinding from the calls correspond to which traversals respectively?

```
int fun(int a) {
  if(a < 3)
        return 1;
  else
        return fun(a-1) + fun(a-2);
}
```

Options :

1. ✗ in order and post order

2. ✗ in order and pre order

3. ✗ post order and pre order

4. ✓ pre order and post order

Question Number : 79 Question Id : 9003001159 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Match the following:

(i) storing type related attributes in symbol table

(ii) Push return address onto stack

(iii) Remove pointer to activation frame.

(iv) Typically used in old interpreted languages

(v) Modern compiled languages

1. SDT
2. Dynamic Scoping
3. Before function call
4. During function call
5. Lexical scoping

Options :

1. ✗ i-1, ii-4, iii- 3, iv-5, v-2

2. ✗ i-2, ii-4, iii-3, iv-5, v-1

3. ✗ i-2, ii-3, iii-4, iv-5, v-1

4. ✓ i-1, ii-3, iii-4, iv-2, v-5

Question Number : 80 Question Id : 9003001160 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the Syntax Directed Translation shown below:

S → 00A {print 'a'} | 1 {print 'b'}

A → S2 {print 'c'}

What is the output generated by this SDT while parsing the string "0000122"?

Options :

1. ✓ bcaca

2. ✗ bacca

3. ✗ babbc

4. ✗ baccb

Question Number : 81 Question Id : 9003001161 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let the average fraction of time a process spends in waiting for I/O completion is 30%. If

there are 8 processes in the memory at once, then what is the CPU utilization?

Options :

1. ✗ 96.12%

2. ✗ 97.33%

3. ✗ 98.99%

4. ✓ 99.99%

Question Number : 82 Question Id : 9003001162 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is not private to a thread?

Options :

1. ✓ Signal and Signal handlers

2. ✗ Program Counter

3. ✗ Stack

4. ✗ Registers

Question Number : 83 Question Id : 9003001163 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following drawback(s) is /are present in the Peterson's solution for achieving mutual exclusion?

(i) Busy waiting

(ii) Race condition

(iii) Priority inversion

(iv) Deadlocks

Options :

1. ✗ only (i)

2. ✓ only (i) and (iii)

3. ✗ only (ii)

4. ✗ only (iv)

Question Number : 84 Question Id : 9003001164 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a paging system with the page table stored in memory. Assume that a memory reference takes 200 nanoseconds. If we add associative registers, and 75 percent of all page-table references are found in the associative registers, what is the effective memory reference time? Assume that finding a page-table entry in the associative registers takes zero time, if the entry is there.

Options :

1. ✗ 200 ns

2. ✗ 225 ns

3. ✓ 250 ns

4. ✗ 275 ns

Question Number : 85 Question Id : 9003001165 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Assume we have a demand-paged memory. The page table is held in registers. It takes 8 milliseconds to service a page fault if an empty page is available or the replaced page is not modified, and 20 milliseconds if the replaced page is modified. Memory access time is 100 nanoseconds. Assume that the page to be replaced is modified 70 percent of the time. What is the maximum acceptable page-fault rate for an effective access time of no more than 200 nanoseconds?

Options :

1. ✗ 0.00004

2. ✗ 0.000002

3. ✗ 0.00007

4. ✓ 0.000006

Question Number : 86 Question Id : 9003001166 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a demand-paging system with the following time-measured utilizations:

CPU utilization: 20%

Paging disk: 97.7%

Other I/O devices: 5%

Which of the following will probably improve CPU utilization?

(i) Installing a faster CPU

(ii) Installing a bigger paging disk

(iii) Decreasing the degree of multiprogramming

(iv) Increasing the page size

Options :

1. ✗ Only (i)

2. ✗ Only (ii) and (iii)

3. ✓ Only (iii)

4. ✗ Only (iii) and (iv)

Question Number : 87 Question Id : 9003001167 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, and 130. Which of the following is the correct increasing order of disk scheduling algorithms, with respect to the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, starting from the current head position?

Options :

1. ✓ SSTF < LOOK < C-LOOK < C-SCAN

2. ✗ SSTF < C-LOOK < LOOK < C-SCAN

3. ✗ C-SCAN < LOOK < C-LOOK < SSTF

4. ✗ C-SCAN< LOOK < SSTF < C-LOOK

Question Number : 88 Question Id : 9003001168 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statement(s) is / are true regarding ensuring security in Operating Systems?

(i) Buffer-overflow attacks can be avoided by adopting a better programming methodology or by using special hardware support.

(ii) A "Salt" is a random number auto-generated for each user by the Operating System to protect user-passwords.

(iii) Any protocol that requires a sender and a receiver to agree on a session key before they start communicating is not prone to the man-in-the-middle attack.

Options :

1. ✓ Only (i) and (ii)

2. ✗ Only (i) and (iii)

3. ✗ Only (ii) and (iii)

4. ✗ Only (ii)

Question Number : 89 Question Id : 9003001169 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Match the condition for deadlock prevention on the left with the appropriate methodology on the right below:

(i) Mutual exclusion	(a) Request all resources initially
(ii) Hold and wait	(b) Take resources away
(iii) No preemption	(c) Order resources numerically
(iv) Circular wait	(d) Spool everything

Options :

1. ✗ (i)-(b), (ii)-(c), (iii)-(d), (iv)-(a)

2. ✓ (i)-(d), (ii)-(a), (iii)-(b), (iv)-(c)

3. ✗ (i)-(a), (ii)-(c), (iii)-(b), (iv)-(d)

4. ✗ (i)-(c), (ii)-(b), (iii)-(a), (iv)-(d)

Question Number : 90 Question Id : 9003001170 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a demand-paging system with a paging disk that has an average access and transfer time of 20 milliseconds. Addresses are translated through a page table in main memory, with an access time of 1 microsecond per memory access. Thus, each memory reference through the page table takes two accesses. To improve this time, we have added an associative memory that reduces access time to one memory reference, if the page-table entry is in the associative memory. Assume that 80 percent of the accesses are in the associative memory and that, of the remaining, 10 percent (or 2 percent of the total) cause page faults. What is the approximate effective memory access time?

Options :

1. ✗ 0.2 milliseconds

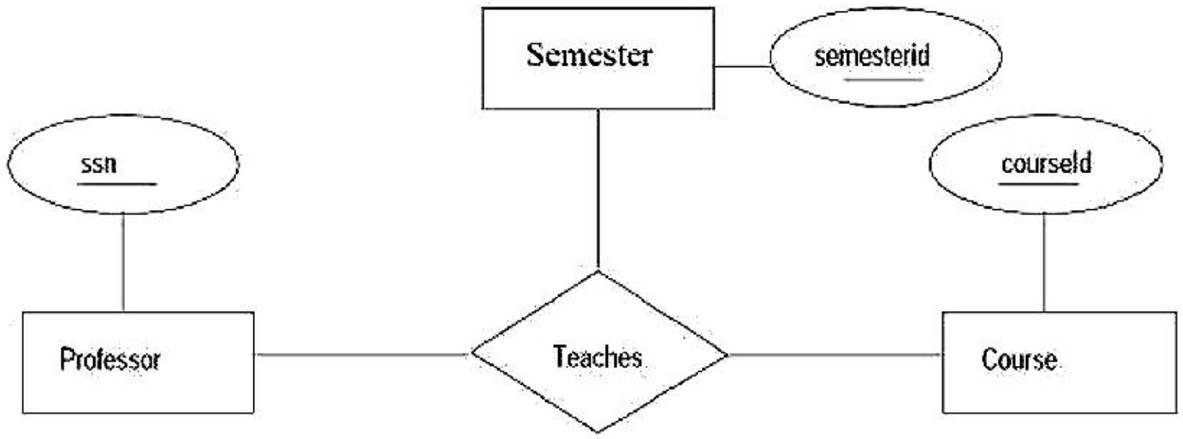
2. ✗ 0.3 milliseconds

3. ✗ 0.4 milliseconds

4. ✓ 0.5 milliseconds

Question Number : 91 Question Id : 9003001171 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A university database contains information about professors (identified by social security number, or SSN) and courses (identified by courseid). Professors teach courses; the following ER diagram concerns the Teaches relationship set.



Which of the following scenario is implied by this ER diagram?

Options :

1. ✓ Professors can teach the same course in several semesters, and each offering must be recorded.

2. ✗ Professors can teach the same course in several semesters, and only the most recent such offering needs to be recorded.

3. ✗ Every professor must teach some course and only the most recent such offering needs to be recorded.

4. ✗ Every professor teaches exactly one course and only the most recent such offering needs to be recorded.

Question Number : 92 Question Id : 9003001172 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Given are two relations $R1$ and $R2$, where $R1$ contains N1 tuples, $R2$ contains N2 tuples, and N2 > N1 > 0. Assume that R1 and R2 are such that the following operations are meaningful. What is the minimum and maximum possible sizes (in tuples) for the resulting relation produced respectively by each of the following relational algebra expressions?

$R1 \cap R2$, and $R1/R2$

Options :

1. ✓ Min: 0, Max: N1 and Min: 0, Max: $\lfloor N2/N1 \rfloor$

2. ✗ Min: N2, Max: N1+N2 and Min: 0, Max: $\lfloor N2/N1 \rfloor$

3. ✗ Min: 0, Max: N1 and Min: 0, Max: $\lfloor N1/N2 \rfloor$

4. ✗ Min: N2, Max: N1+N2 and Min: 0, Max: $\lfloor N1/N2 \rfloor$

Question Number : 93 Question Id : 9003001173 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the following relations containing airline flight information:

Flights(*flno:* integer, *from:* string, *to:* string, *distance:* integer, *departs:* time, *arrives:* time)

Aircraft(*aid:* integer, *aname:* string, *cruisingrange:* integer)

Certified(*eid:* integer, *aid:* integer)

Employees(*eid:* integer, *ename:* string, *salary:* integer)

Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft (otherwise, he or she would not qualify as a pilot), and only pilots are certified to fly.

What is the output of the following Relational Algebra expression?

$$\rho(E1, Employees)$$
$$\rho(E2, Employees)$$
$$\rho(E3, \pi_{E2.eid}(E1 \bowtie_{E1.salary > E2.salary} E2)$$
$$\rho(E4, E2 \bowtie E3)$$
$$\rho(E5, E2 \bowtie E3)$$
$$\rho(E6, \pi_{E5.eid}(E4 \bowtie_{E1.salary > E5.salary} E5)$$
$$(\pi_{eid} E3) - E6$$

Options :

1. ✗ Returns the ids of the employees who make the highest salary.

2. ✓ Returns the ids of the employees who make the second highest salary.

3. ✗ Returns the ids of the employees who make the third highest salary.

4. ✗ Returns the ids of the employees who make the fourth highest salary.

Question Number : 94 Question Id : 9003001174 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the following schema:

Suppliers(sid: integer, sname: string, address: string)

Parts(pid: integer, pname: string, color: string)

Catalog(sid: integer, pid: integer, cost: real)

The Catalog relation lists the prices charged for parts by Suppliers. What is the output of the following SQL query?

```
SELECT S.sname
FROM Suppliers S
WHERE NOT EXISTS (( SELECT P.pid
                    FROM Parts P )
                    EXCEPT
                    ( SELECT C.pid
                    FROM Catalog C
                    WHERE C.sid = S.sid ))
```

Options :

1. ✗ Finds sname of Suppliers who supply at least one part.

2. ✓ Finds sname of Suppliers who supply every part.

3. ✗ Finds sname of all Suppliers.

4. ✗ No output as the query is not well-formed.

Question Number : 95 Question Id : 9003001175 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How many clustered indexes can be created on a file?

Options :

1. ✓ At most 1

2. ✗ At most 2

3. ✗ At least 1

4. ✗ No upper or lower bound exists.

Question Number : 96 Question Id : 9003001176 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the minimum space utilization for a B+ tree index?

Options :

1. ✗ 25%

2. ✓ 50%

3. ✗ 60%

4. ✗ 75%

Question Number : 97 Question Id : 9003001177 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a database with objects X and Y and assume that there are two transactions $T1$ and $T2$. Transaction $T1$ reads objects X and Y and then writes object X. Transaction $T2$ reads objects X and Y and then writes objects X and Y.

Which of the following statement(s) is / are true?

(i) The schedule T2:R(X), T2:R(Y), T2:W(X), T1:R(X) ... results in a write-read conflict.

(ii) The schedule T2:R(X), T2:R(Y), T1:R(X), T1:R(Y), T1:W(X) ... does not result in a read-write conflict.

(iii) The schedule T2:R(X), T2:R(Y), T1:R(X), T1:R(Y), T1:W(X), T2:W(X) ... results in a write-write conflict.

Options :

1. ✗ Only (i)

2. ✗ Only (i) and (ii)

3. ✗ Only (ii) and (iii)

4. ✓ Only (i) and (iii)

Question Number : 98 Question Id : 9003001178 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following Software Development models has cycles comprising of inception, elaboration, construction and transition phases?

Options :

1. ✗ Timeboxing model

2. ✗ Iterative development

3. ✓ Rational unified process model

4. ✗ Waterfall model

Question Number : 99 Question Id : 9003001179 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the cyclomatic complexity of the following block of code?

```
{
    i = 1;
    while (i <= n) {
        j = i;
        while (j <= i) {
            if (A[i] < A[j])
                swap(A[i], A[j]);
            j = j + 1; }
    i = i + 1; }
}
```

Options :

1. ✗ 3

2. ✓ 4

3. ✖ 5

4. ✖ 6

Question Number : 100 Question Id : 9003001180 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that while testing a software, the total number of defects logged is 500, out of which 20 were found after delivery, and 200 were found during the system testing. What is the defect removal efficiency of the system testing and the overall testing process respectively?

Options :

1. ✔ 91% and 96%

2. ✖ 96% and 91%

3. ✖ 96% and 96%

4. ✖ 91% and 91%

Question Number : 101 Question Id : 9003001181 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Sixteen-bit messages are transmitted using a Hamming code. How many check bits are needed to ensure that the receiver can detect and correct single bit errors?

Options :

1. ✖ 2

2. ✖ 3

3. ✖ 4

4. ✔ 5

Question Number : 102 Question Id : 9003001182 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is $x^3 + 1$. What is the actual bit string transmitted?

Options :

1. ✔ 10011101100

2. ✖ 10011101101

3. ✖ 10011101001

4. ✖ 10011101110

Question Number : 103 Question Id : 9003001183 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A 1-km-long, 10-Mbps CSMA/CD LAN (not 802.3) has a propagation speed of 200 m/μsec. Repeaters are not allowed in this system. Data frames are 256 bits long, including 32 bits of header, checksum, and other overheads. The first bit slot after a successful transmission is reserved for the receiver to capture the channel in order to send a 32-bit acknowledgement frame,What is the effective data rate, excluding overheads, assuming that there are no collisions?

Options :

1. ✖ 3.0 Mbps

2. ✓ 3.8 Mbps

3. ✗ 4.5 Mbps

4. ✗ 5.0 Mbps

Question Number : 104 Question Id : 9003001184 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that instead of using 16 bits for the network part of a class B address originally, 20 bits had been used. How many Class B networks would there have been?

Options :

1. ✗ 1048576

2. ✗ 65536

3. ✗ 524288

4. ✓ 262142

Question Number : 105 Question Id : 9003001185 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A network on the Internet has a subnet mask of 255.255.240.0. What is the maximum number of hosts it can handle?

Options :

1. ✗ 1024

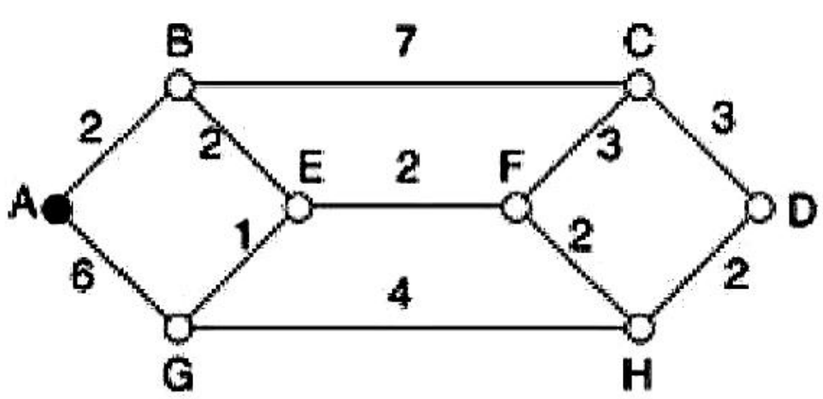
2. ✖ 2048

3. ✔ 4096

4. ✖ 8192

Question Number : 106 Question Id : 9003001186 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the network shown in the figure below; but ignore the weights on the lines. Suppose that it uses flooding as the routing algorithm. If a packet sent by *A* to *D* has a maximum hop count of 3, how many hops worth of bandwidth it consumes?



Options :

1. ✖ 16

2. ✖ 20

3. ✔ 24

4. ✖ 28

Question Number : 107 Question Id : 9003001187 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let B_{pu} and B_{pr} be the public and private keys of the entity B. Similarly, let A_{pu} and A_{pr} be the public and private keys of the entity A. Let entity A transmit a message m to entity B, by adopting the following steps: (|| indicates the padding operation)

Step 1: x = encryptUsingRSA(m, A_{pr})

Step 2: y = encryptUsingRSA(m || x, B_{pu})

Step 3: Transmit y to entity B.

Which of the following aspects of security are achieved in this communication?

(i) Confidentiality

(ii) Integrity

(iii) Non-repudiation

Options :

1. ✖ Only (iii)

2. ✖ Only (i) and (ii)

3. ✖ Only (i) and (iii)

4. ✔ (i), (ii) and (iii)

Question Number : 108 Question Id : 9003001188 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response

Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following HTML tags is used to draw graphics, on the fly, via scripting?

Options :

1. ✗ <area>

2. ✓ <canvas>

3. ✗ <embed>

4. ✗ <fieldset>

Question Number : 109 Question Id : 9003001189 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the filtering effect of the XPATH expression /literature//author[firstname]?

Options :

1. ✗ Retrieves all author tags having the namespace “firstname”, that are descendants of the root tag “literature”.

2. ✗ Retrieves all author tags having an attribute “firstname”, that are descendants of the root tag “literature”.

3. ✓ Retrieves all author tags having a child-tag named “firstname”, that are descendants of the root tag “literature”.

4. ✗ Retrieves all author tags that are descendants of the root tag “literature”.

Question Number : 110 Question Id : 9003001190 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statement(s) is / are true?

(i) Stubs perform serialization of parameters of remote function calls.

(ii) Stub is responsible for dispatching the call to the actual remote object or function implementation.

(iii) HTTP's restful API comprises of a PATCH method to partially update a server-side resource.

Options :

1. ✗ Only (i)

2. ✗ Only (i) and (ii)

3. ✓ Only (i) and (iii)

4. ✗ Only (ii) and (iii)

Question Number : 111 Question Id : 9003001191 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For what values of a, m and b, the Lagrange's mean value theorem is applicable to the function

$$f(x) = \begin{cases} 3; & if\, x = 0 \\ -x^2 + 3x + a; & if\, 0 < x < 1 \\ mx + b; & if\, 1 \le x \le 2 \end{cases} \quad \text{for } x \in [0,2]$$

Options :

1. ✓ $a = 3, m = 1, b = 4$

2. ✗ $a = 3, m = -1, b = 4$

3. ✗ $a = 3, m = -1, b = -4$

4. ✖ $a = 3, m = 1, b = -4$

Question Number : 112 Question Id : 9003001192 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The numbers a and b $(a \leq b)$ such that $\int_a^b (4 - x^2)dx$ has its largest value are

Options :

1. ✖ $a = -2, b = 3$

2. ✖ $a = 2, b = 3$

3. ✔ $a = -2, b = 2$

4. ✖ $a = 2, b = 5$

Question Number : 113 Question Id : 9003001193 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The iteration formula to approximate $\sqrt{2}$ by Newton's method is

Options :

1. ✖ $x_{n+1} = x_n - \frac{x_n^2 - 2}{(x_n + x_{n-1})}$

2. ✖ $x_{n+1} = x_n - \frac{2}{x_n}$

3. ✖ $x_{n+1} = x_n - \frac{x_n}{2}$

4. ✓ $x_{n+1} = x_n - \frac{x_n^2 - 2}{2x_n}$

Question Number : 114 Question Id : 9003001194 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The value of $\int_0^1 e^{-x^2} dx$ by Simpson's $\frac{1}{3}$ rule with $h = \frac{1}{4}$ is

Options :

1. ✓ 0.74681

2. ✗ 0.69891

3. ✗ 0.75012

4. ✗ 0.81203

Question Number : 115 Question Id : 9003001195 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let P be a 4 x 4 matrix whose determinant is 10. The determinant of $-3P$ is

Options :

1. ✗ - 810

2. ✗ -30

3. ✗ 30

4. ✓ 810

Question Number : 116 Question Id : 9003001196 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The possible set of eigenvalues of a 4 x 4 skew-symmetric orthogonal real matrix is

Options :

1. ✗ $\{\pm i, \pm 1\}$

2. ✗ $\{0\}$

3. ✓ $\{\pm i\}$

4. ✗ $\{\pm i, 0\}$

Question Number : 117 Question Id : 9003001197 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $f(x) = kx^2$ if $0 \leq x \leq 2$ and 0 otherwise. The value of c such that $P(x \leq c) = 0.1$ is

Options :

1. ✓ 0.9283

2. ✗ 0.8734

3. ✗ 0.7513

4. ✗ 1.234

Question Number : 118 Question Id : 9003001198 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response

Time : N.A Think Time : N.A Minimum Instruction Time : 0

An urn contains 5 red balls and 2 green balls. A ball is drawn. If it is green, a red ball is added to the urn and if it is red, a green ball is added to the urn. (The original ball is not returned to the urn). Then a second ball is drawn. What is the probability that the second ball is red?

Options :

1. ✗ $\frac{20}{49}$

2. ✓ $\frac{32}{49}$

3. ✗ $\frac{12}{49}$

4. ✗ $\frac{25}{49}$

Question Number : 119 Question Id : 9003001199 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $A = \{a, b, c, d\}$ and $B = \{1,2,3\}$ then which of the following is correct

Options :

1. ✓ Total number of functions from A to B are 3^4.

2. ✗ Total number of functions from B to A are 3^4.

3. ✖ Total number of one-one functions from B to A are 12.

4. ✖ Total number of one-one functions from B to A are 0.

Question Number : 120 Question Id : 9003001200 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $(G, @)$ be an abelian group, then for all $a, b \in G$, $b^{-1}@a^{-1}@b@a$ is equal to

Options :

1. ✖ $a * b$

2. ✖ $a^{-1} * b^{-1}$

3. ✔ *e, the identity of the group*

4. ✖ $a^{-1} * \mathrm{b}$