Introduction to Soft Computing

Assignment 0

TYPE OF QUESTION: MCQ

Number of questions: 15 **Total mark: 15 × 1 = 15**

QUESTION 1:

If A, B and C are any three sets, then A – (B ∪ C) is equal to

a. (A – B) ∪ (A – C)
b. (A – B) ∪ C
c. (A – B) ∩ C
d. (A – B) ∩ (A – C)

Correct Answer: d
Explanation:
A − (B ∪ C) = A ∩ (B ∪ C) ′ = A ∩ (B′∩ C′) = (A ∩ B′) ∩ (A ∩ C′) = (A − B) ∩ (A − C)

QUESTION 2:

Which one of the following is minimized form of the logical expression $(X + X'Z + YZ)$?

a. $Y + Z$
b. $X + Z$
c. $X' + Z$
d. $X + Y + Z$

Correct Answer: b
Explanation:

$$
\begin{aligned}
X + X'Z + YZ &= (X + X')(X + Z) + YZ && \textit{(Distributive Law)} \\
&= (X + Z) + YZ && (X + X' = 1) \\
&= X + Z + YZ && \\
&= X + Z(1 + Y) && (1 + Y = 1) \\
&= X + Z &&
\end{aligned}
$$

QUESTION 3:

If $A = \{0, 1\}$ and $B = \{1,2, 3\}$, then which of the following statements is true about the Cartesian products of A and B?

a. $A \times B = B \times A$
b. Cartesian product between A and B is not possible
c. $A \times B \neq B \times A$
d. None of the above

Correct Answer: c
Explanation:
$A = \{0,1\}$
$B = \{1,2,3\}$
$A \times B = \{(0,1), (0,2), (0,3), (1,1), (1,2), (1,3)\}$
$B \times A = \{(1,0), (2,0), (3,0), (1,1), (2,1), (3,1)\}$
By the definition of equality of ordered pairs, the pair (0,1) in $A \times B$ is not equal to the pair (1,0) in $B \times A$
Therefore, $A \times B \neq B \times A$

QUESTION 4:

Find all the points of local maxima and local minima of the function $f(x) = (x - 1)^3(x + 1)^2$

a. $1, -1, -1/5$
b. $1, -1$
c. $1, -1/5$
d. $-1, -1/5$

Correct Answer: a
Explanation:
Differentiate the function w.r.t x, and equate it to zero. Then find the values of x.

QUESTION 5:

A function $f(x)$ is defined as $f(x) = \frac{1}{1+e^{-x}}$. The derivative of $f(x)$ with respect to x is given by $f'(x)$. Which of the following relationship is true?

a. $f'(x) = f(x)(1 + f(x))$
b. $f'(x) = f(x)(f(x) - 1)$
c. $f'(x) = f(x)\left(1 - f(x)\right)$
d. $f'(x) = 1 - f(x)$

Correct Answer: c
Explanation:

$$f'(x) = \frac{d}{dx}\left(\frac{1}{1+e^{-x}}\right) = \frac{e^{-x}}{(1+e^{-x})^2} = \frac{(1+e^{-x})-1}{(1+e^{-x})^2}$$

$$= \frac{1}{(1+e^{-x})} - \frac{1}{(1+e^{-x})^2} = \frac{1}{1+e^{-x}}\left(1 - \frac{1}{1+e^{-x}}\right)$$

$$= f(x)(1 - f(x))$$

QUESTION 6:

A card is drawn at random from a pack of 52 cards. It is seen that the drawn card is a club. Next, another card is drawn without replacing the first card. What is the probability that the card drawn later, will be a club?

a) $\frac{13}{52}$
b) $\frac{12}{52}$
c) $\frac{13}{51}$
d) $\frac{12}{51}$

Correct Answer: d
Detailed Explanation:
After the first draw, the remaining number of cards $= 51$
The remaining number of clubs $= 13 - 1 = 12$
So, the required probability $= \frac{12}{51}$

QUESTION 7:

Let R be a relation "$(x - y)$ is divisible by m", where x, y, m are integers and $m > 1$, then R is

a. symmetric but not transitive
b. partial order
c. equivalence relation
d. anti-symmetric and not transitive

Correct Answer: c
Explanation:
Consider any x, y, z ∈ Z.
(i) Since $x - x = 0$ and 0 is divisible by m, therefore, xRx i.e. R is reflexive.
(ii) If xRy, then $x - y$ is divisible by $m \Rightarrow -(x - y)$ is divisible by $m \Rightarrow y - x$ is divisible by m
$\therefore yRx$ i.e. R is symmetric.
(iii) If xRy and yRx, then $x - y$ is divisible by m and $y - z$ is divisible by m
Hence, $x - y = mq$ and $y - z = mq'$ where $q, q' \in Z$
$\Rightarrow (x - y) + (y - z) = m(q + q')$
$\Rightarrow x - z = m(q + q')$ but
$\therefore x - z$ is divisible by m then xRz i.e. R is transitive.
The relation R is reflexive, symmetric and transitive, hence it is an equivalence relation.

QUESTION 8:

$f : R \rightarrow R$ is a function defined by $f(x) = 10x - 7$. If $g = f^{-1}$, then $g(x) = ?$

a. $\frac{1}{10x-7}$
b. $\frac{1}{10x+7}$
c. $\frac{x+7}{10}$
d. $\frac{x-7}{10}$

Correct Answer: c

Explanation:
Let, $y = 10x - 7$
Hence, x= $\frac{y+7}{10}$
Since the choice of the variable is arbitrary, we can write this as
$g(x) = \frac{x+7}{10}$

QUESTION 9:

The number of elements in the power set P of the set $S = \{\{\varphi\}, 1, \{2,3\}\}$ is

a. 2
b. 4
c. 8
d. None of these

Correct Answer: c
Explanation:
There are 3 elements in this set S, they are $\{\varphi\}, 1, and\ \{2,3\}$. The number of elements in the power set of S is $2^n = 2^3 = 8$

QUESTION 10:

Let S be a set of points inside a square, T be the another set of points inside a triangle and C is the another set of points inside a circle. If the triangle and circle intersect each other and are contained in a square, then

a. $S \cap T \cap C = \phi$
b. $S \cup T \cup C = C$
c. $S \cup T \cup C = S$
d. $S \cup T = S \cap C$

Correct Answer: c
Explanation:
As square S contains both the triangle T and the circle C, so $S \cup T \cup C = S$

QUESTION 11:

In a language survey of students, it is found that 80 students know English, 60 know French, 50 know German, 30 know English and French, 20 know French and German, 15 know English and German and 10 students know all the three languages. How many students know at least one language?

a. 135
b. 30
c. 10
d. 45

Correct Answer: a

Explanation:

$E = 80;\ F = 60;\ G = 50;$

$(E \cap F) = 30; (F \cap G) = 20; (E \cap G) = 15; (E \cap F \cap G) = 10. (Given)$

Number of students who knows at least one language

$= E + F + G - (E \cap F) - (F \cap G) - (E \cap G) + (E \cap F \cap G)$

$= 80 + 60 + 50 - 30 - 20 - 15 + 10$

$= 135$

QUESTION 12:

Which of the following sets is a null set?

I. $X = \{x = 9, 2x = 4\}$
II. $Y = \{x = 2x,\ x \neq 0\}$
III. $Z = \{x - 8 = 4\}$

a. I and II only
b. I, II and III
c. I and III only
d. II and III only

Correct Answer: a
Explanation:
Set X is a null set, since, if $x = 9$, then $2x \neq 4$.
Set Y is a null set, since, if $x = 2x$, then x must be equal to 0.
Set Z has one element, that is $x = 4$.

QUESTION 13:

Dry-run the program and compute the final value of a, b, and c

```
#include<stdio.h>
int main()
{
        int a = 100, b = 200, c = 300;
        if (!(a >= 500))
                b = 300;
                c = 400;
        printf("%d, %d, %d", a, b, c);
        return 0;
}
```

a. 100, 300, 300
b. 100, 200, 400
c. 100, 200, 300
d. 100, 300, 400

Correct Answer: d
Explanation:
Here, (a >= 500) returns False.
So, (!(a >= 500)) evaluates to be True.
So, the value of b and c will be updated.

QUESTION 14:

Degree of the polynomial $4x^4 + 0x^3 + 0x^5 + 5x + 7$ is

a. 4
b. 5
c. 3
d. 7

Correct Answer: a

Explanation:

The degree of a polynomial is the highest power of the variable in a polynomial expression.

QUESTION 15:

The system of linear equation is as follows
$x + y + z = 3, x + 2y + 3z = 0,\ and\ x + 3y + 2z = 3$
The solution of this system will be-

a. $x = 4, y = 1, z = -2$
b. $x = 2, y = 1, z = -2$
c. $x = 4, y = 0, z = -1$
d. $x = 2, y = 1, z = -1$

Correct Answer: a
Explanation:
The solution set of a system of linear equation can be obtained by the Gaussian elimination method. It is performed by row-reduction of the augmented matrix.

The augmented matrix for the given equation is $\left(\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 1 & 2 & 3 & 0 \\ 1 & 3 & 2 & 3 \end{array}\right)$

$$\left(\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 1 & 2 & 3 & 0 \\ 1 & 3 & 2 & 3 \end{array}\right) \xrightarrow[R_2' = R_2 - R_1]{} \left(\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 0 & 1 & 2 & -3 \\ 1 & 3 & 2 & 3 \end{array}\right) \xrightarrow[R_3' = R_3 - R_1]{} \left(\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 0 & 1 & 2 & -3 \\ 0 & 2 & 1 & 0 \end{array}\right) \xrightarrow[R_2' = 2R_2]{} \left(\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 0 & 2 & 4 & -6 \\ 0 & 2 & 1 & 0 \end{array}\right)$$

$$\left(\begin{array}{ccc|c}1 & 1 & 1 & 3\\ 0 & 2 & 4 & -6\\ 0 & 2 & 1 & 0\end{array}\right) \xrightarrow{\hspace{2em}} R_3' = R_3 - R_2 \left(\begin{array}{ccc|c}1 & 1 & 1 & 3\\ 0 & 2 & 4 & -6\\ 0 & 0 & -3 & 6\end{array}\right)$$

So, $-3z = 6, Or, z = -2$
$and, 2y + 4z = -6, Or, y = 1$
$and, x + 1 + (-2) \times 1 = 3, Or, x = 4$
The solution set is $x = 4, y = 1, z = -2$

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