**Subject:** Discrete Structure

**Program:**  BS (SE)

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Midterm Assignment

**I.D:** 15757

**Section:**  (A)

**Q.1**

Which of the following are propositions?

1. Buy Premium Bonds!

* The Apple Macintosh is a 16 bit computer.
* There is a largest even number.

1. Why are we here?
2. 8 + 7 = 13
3. a + b = 13

Answer:

* B & C

**Q.2**

p is "x < 50"; q is "x > 40".

Write as simply as you can:

(a) ¬p

(b) ¬q

(c) p ˄ q

(d) p ∨ q

(e) ¬p ˄ q

(f) ¬p ˄¬q

Answer:

(a) x ≥ 50

(b) x ≤ 40

(c)  40 < x < 50

(d)  x < 50 or x > 40

(e) x ≥ 50

(f) x ≥ 50 and x ≤ 40

**Q.3**

In each part of this question a proposition p is defined. Which of the statements that follow the definition correspond to the proposition ¬p? (There may be more than one correct answer.)

(a)

p is "Some people like Maths".

(a) "Some people dislike Maths"

(b) "Everybody dislikes Maths"

(c) "Everybody likes Maths"

Answer:

(b). is proposition

b)

p is "The answer is either 2 or 3".

(a) "Neither 2 nor 3 is the answer"

(b) "The answer is not 2 or it is not 3"

(c) "The answer is not 2 and it is not 3"

Answer:

1. & (c). both are proposition

c)

p is "All people in my class are tall and thin".

(a) "Someone in my class is short and fat"

(b) "No-one in my class is tall and thin"

(c) "Someone in my class is short or fat"

Answer:

(c). is proposition

**Q.4**

Construct truth tables for:

1. ¬p ∨ ¬q
2. q˄ (¬p ∨ q)
3. p ˄ (q ∨ r)
4. (p˄ q) ∨ r

Table for (A)

|  |  |  |
| --- | --- | --- |
| **p** | **Q** | **-p Ѵ -q** |
| **F** | **F** | **T** |
| **F** | **T** | **T** |
| **T** | **F** | **T** |
| **T** | **T** | **F** |

**Table for (B)**

|  |  |  |
| --- | --- | --- |
| **p** | **Q** | **q^ (-p Ѵ q)** |
| **F** | **F** | **F** |
| **F** | **T** | **T** |
| **T** | **F** | **F** |
| **T** | **T** | **T** |

**Table for (C)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **p** | **Q** | **r** | **(q V r)** | **p^(q V r)** |
| **T** | **T** | **T** | **T** | **T** |
| **T** | **T** | **F** | **T** | **T** |
| **T** | **F** | **T** | **T** | **T** |
| **T** | **F** | **F** | **F** | **F** |
| **F** | **T** | **T** | **T** | **F** |
| **F** | **T** | **F** | **T** | **F** |
| **F** | **F** | **T** | **T** | **F** |

**Table for (D)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **p** | **Q** | **r** | **(p ^ q)** | **(p ^ q) V r** |
| **T** | **T** | **T** | **T** | **T** |
| **T** | **T** | **F** | **T** | **T** |
| **T** | **F** | **T** | **F** | **T** |
| **T** | **F** | **F** | **F** | **F** |
| **F** | **T** | **T** | **F** | **T** |
| **F** | **T** | **F** | **F** | **F** |
| **F** | **F** | **T** | **F** | **T** |

**Q.5**

Use truth tables to show that:

¬ ((p ∨ ¬q) ∨ (r ˄ (p ∨ ¬q))) ≡ ¬p ˄ q

Answer:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| p | Q | R | -(p V –q) | (r^(p V q) | -[(p V –q) V (r^ (p V –q)] | -p ^ q |
| T | T | T | F | F | F | F |
| T | T | F | F | F | F | F |
| T | F | T | F | F | F | F |
| T | F | F | F | F | F | F |
| F | T | T | T | T | T | T |
| F | T | F | T | F | T | T |
| F | F | T | F | F | F | F |

**Q.6**

Use the laws of logical propositions to prove that:

(z ˄ w) ∨ (¬z w) ∨ (z ˄ ¬w) ≡ z ∨ w

State carefully which law you are using at each stage.

Answer:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Z | W | -Z | -W | Z^W | -ZW | Z^-W | (z ^ w)V (-z w)V (z^-w) | z V w |
| T | T | F | F | T | F | F | T | T |
| T | F | F | T | F | F | T | T | T |
| F | T | T | F | F | T | F | T | T |
| F | F | T | T | F | F | F | F | F |

Thus we prove that (z ˄ w) ∨ (¬z w) ∨ (z ˄ ¬w) ≡ z ∨ w

We can see that both are equal.