**BRAC University**
**Department of Computer Science and Engineering (CSE)**

# CSE230: Discrete Mathematics

**SET - A** | Semester: **Spring 2024** | Examination: **Quiz 2** | Time: **20 minutes** | Full marks: **20**

Name: _____ ID: _____ Section: ____

*(There are 4 questions total. You must answer all. Answer Q3 and Q4 after the line.*
*Feel free to use the back of the question paper, if needed.)*

1.4/18

**Q1.** Suppose that the domain of the propositional function $P(x)$ consists of the integers −2, −1, 0, 1, and 2. Write out each of these propositions using disjunctions, conjunctions, and negations:

| | |
|---|---|
| **(a)** $\forall x \neg P(x)$ | $\neg P(-2) \wedge \neg P(-1) \wedge \neg P(0) \wedge \neg P(1) \wedge \neg P(2)$ |
| **(b)** $\neg \exists x P(x)$ | $\neg (P(-2) \vee P(-1) \vee P(0) \vee P(1) \vee P(2))$ |

**[1+1=2 marks]**

1.4/12

**Q2.** Let $Q(x)$ be the statement "$x + 1 > 2x$." If the domain consists of **all integers**, what are the truth values of the following statements? (Just circle the correct value)

$\neg Q(x)$ = "$x+1 \leq 2x$"

**(a)** $Q(-1)$ : (T) / F $\quad -1+1 > -2 \Rightarrow 0 > -2 \Rightarrow T$

**(b)** $\forall x Q(x)$ : T / (F) $\quad Q(5) =$ "$5+1 > 10$" $=$ "$6 > 10$" $= F$

**(c)** $\exists x \neg Q(x)$ : (T) / F $\quad \neg Q(5) =$ "$6 \leq 10$" $= T$

**[1+1+1=3 marks]**

1.4/25

**Q3.** Translate each of these statements into logical expressions using predicates, quantifiers, and logical connectives:
(Describe/Define your propositional functions and write down the needed expression)

**(a)** Everyone is your friend and is perfect.

**(b)** Not everybody is your friend or someone is not perfect.

**[2.5+2.5=5 marks]**

1.3/33+34

**Q4.** Show that $(p \rightarrow q) \wedge (q \rightarrow r) \rightarrow (p \rightarrow r) \equiv (p \vee q) \wedge (\neg p \vee r) \rightarrow (q \vee r) \equiv \mathbf{T}$.
(Simply show that both compound propositions are Tautology. You may use any method preferred.)

**[5+5=10 marks]**

*End*

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Q3. Let, $P(x)$ := "$x$ is perfect"
$F(x)$ := "$x$ is your friend."
where Domain of $x$ is all people.

Then, statement (a) $\Rightarrow \forall x P(x) \wedge \forall x F(x) \Rightarrow \forall x (P(x) \wedge F(x))$

and, statement (b) $\Rightarrow \neg \forall x (F(x)) \vee \exists x (\neg P(x))$