

DISCRETE MATHEMATICS (DBM2033)

Session December 2017

SELF-EXERCISE 3

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Instructions

- Answer ALL questions. Write your answers in the spaces provided.
  - Show your working. You may use a non-programmable scientific calculator.
1. Complete these specifications into English where  $F(x)$  is “ $x$  is out of service”,  $B(x)$  is “ $x$  is busy”,  $L(y)$  is “ $y$  is lost” and  $Q(y)$  is “ $y$  is queued”. The domain of  $x$  is all printers and the domain of  $y$  is all printer jobs.
    - (a)  $\forall x B(x) \leftrightarrow \exists y Q(y)$
    - (b)  $\exists y (Q(y) \wedge L(y)) \rightarrow \sim \forall x F(x)$
    - (c)  $\forall x B(x) \vee (\forall y Q(y) \rightarrow \exists y L(y))$
  2. Apply rules of inference to show the hypotheses “Siti studies hard alone”, “If Siti studies hard alone, then she is a lonely girl” and “If Siti is a lonely girl, then she will not have many friends” imply the conclusion “Siti will not have many friends”.
  3. Let  $A = \{1, 2, 3, 4, 5\}$ . Determine the truth value of each of the following statements:
    - (a)  $(\exists x \in A)(x + 3 = 10)$
    - (b)  $(\forall x \in A)(x + 3 < 10)$
    - (c)  $(\exists x \in A)(x + 3 < 5)$
    - (d)  $(\forall x \in A)(x + 3 \leq 7)$
  4. Negate each of the following statements:
    - (a) All students live in the dormitories.
    - (b) All mathematics majors are males.
    - (c) Some students are 25 years old or older.
  5. Let  $E(x, y)$  be the predicate “ $x$  is expensive than  $y$ ” and let the universe of discourse be the set of cars. Express each of the following quantification in English.
    - (a)  $\exists x \exists y E(x, y)$
    - (b)  $\exists x \sim E(x, Ferrari)$
    - (c)  $\sim \forall x \exists y E(x, y)$