CS1231–Midterm 1, 2016

Name: **Matric No:**

1. [3 marks] Using a truth table, determine if the following is a contingency.

$$(p \vee \neg q) \wedge (q \vee \neg r) \wedge (p \to r)$$

p	q	r	$p \vee \neg q$	$q \vee \neg r$	$p \to r$	$(p \vee \neg q) \wedge (q \vee \neg r) \wedge (p \to r)$
T	T	T				
T	T	F				
T	F	T				
F	T	T				
T	F	F				
F	T	F				
F	F	T				
F	F	F				

Ans: yes / no

2. [2 marks] Is it possible to assign truth values to p, q, r so that the all the following are simultaneously true? If so give all the possible assignments.

$$p \vee \neg q, \quad q \vee \neg r, \quad p \to r$$

Ans: yes / no

Assignments: $(p, q, r) =$

3. [2 marks] Translate the following into a logical expression using $S(x)$ for "x is a Singaporean", $K(x)$ for "x is Kiasu" and with D, the set of all human beings as the domain.

"All Singaporeans are Kiasu."

Ans:

4. [4 marks] Suppose there are m cards $C_1, \ldots, C_m$ and n boxes $B_1, \ldots, B_n$. Let $X = \{1, \ldots, m\}$, $Y = \{1, \ldots, n\}$, $P(i, j)$ be "C_i is in B_j" and $Q(i, j)$ be "$i \neq j$". Translate each of the following into English.

(a) $\forall j \in Y \; \exists i \in X \; P(i, j)$.

Ans:

(b) $\forall i \in X \; \exists j \in Y \; P(i, j)$.

Ans:

(c) $\forall i \in X \; \forall j \in X \; \forall k \in Y \; Q(i, j) \to (P(i, k) \to \neg P(j, k))$

Ans:

5. [2 marks] Negate (c) in the previous question and translate the negation into English.

Negation:

English:

6. [3 marks] Answer the following with justifications.

If $\exists x \forall y P(x, y)$ is true, does it follow that $\forall y \exists x P(x, y)$ is true?

Ans: | yes / no |. Justification:

7. [4 marks] Derive the conclusion $\neg q$ from the following given hypotheses:

(a) $\neg p \vee q \rightarrow r$, (b) $s \vee \neg q$, (c) $\neg t$, (d) $p \rightarrow t$, (e) $\neg p \wedge r \rightarrow \neg s$.