King Fahd University of Petroleum and Minerals

College of Computer Science and Engineering
Information and Computer Science Department

ICS 253-01: Discrete Structures I
Summer 2012-2013
Quiz#1, Tuesday June 11, 2013.

Name:

ID#: Possible Solutions

1. (10 points) Are these system specifications consistent? "The system is in multiuser state if and only if it is operating normally. If the system is operating normally, the kernel is functioning. The kernel is not functioning or the system is in interrupt mode. If the system is not in multiuser state, then it is in interrupt mode. The system is not in interrupt mode."
Show all your work.

2

$p \equiv$ The system is in multiuser state
$q \equiv$ The system is operating normally
$r \equiv$ The kernel is functioning
$s \equiv$ The system is in interrupt mode

1. $p \leftrightarrow q$
2. $q \rightarrow r$
3. $\neg r \vee s$
4. $\neg p \rightarrow s$
5. $\neg s$

2

$\neg s = T \iff s = F$.

$\neg p = F$ (otherwise 4 will be false)

$\therefore p = T$.

$\therefore q = T$.

$\therefore r = T$. (otherwise 2 is false).

but $\neg r \vee s \equiv F \vee F = F$

$\Longrightarrow$ 3 is false.

$\therefore$ It is not consistent.

6

2. (5 points) For the following compound proposition:
"It rains only if there are clouds in the sky."
   a. (2 points) Represent it as an implication $p \rightarrow q$
   b. (3 points) State, in proper English statements, the inverse, the converse and the contrapositive statements of the above statement.

2 a. $p \equiv$ it rains $\quad q \equiv$ There are clouds in the sky

1 b. Converse: $q \rightarrow p$: If there are clouds in the sky, it rains

1 Contrapositive: $\neg q \rightarrow \neg p$: If there are no clouds in the sky, it is not raining.

1 Inverse: $\neg p \rightarrow \neg q$: If it is not raining, there are no clouds in the sky.

3. (5 points) Determine whether $(\neg p \wedge (p \rightarrow q)) \rightarrow \neg q$ is a tautology or not, showing all your work.

p	q	$\neg p$	$\neg q$	$p \rightarrow q$	$\neg p \wedge (p \rightarrow q)$	$(\neg p \wedge (p \rightarrow q)) \rightarrow \neg q$
F	F	T	T	T	T	T
F	T	T	F	T	T	F
T	F	F	T	F	F	T
T	T	F	F	T	F	T

1 1 1 1

1 it is not a tautology.