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 Session 2016-2017
Quiz#1, Thursday July 13, 2017.

Name:

ID#:

1. (6 points) Let *p*, *q*, and *r* be the propositions

    p : Monkeys have been seen in the area.
    q : Walking is safe on the trail.
    r : Bananas are ripe along the trail.

    Write these propositions using logical connectives (including negations).

    Monkeys have not been seen in the area and walking on the trail is safe, but bananas are ripe along the trail.

    $$\neg p \wedge q \wedge r$$

    For walking on the trail to be safe, it is necessary that bananas not be ripe along the trail and for monkeys not to have been seen in the area.

    $$q \rightarrow (\neg r \wedge \neg p)$$

    If bananas are ripe along the trail, then walking is safe if and only if monkeys have not been seen in the area.

    $$r \rightarrow (q \leftrightarrow \neg p)$$

2. (4 points) Evaluate the following expressions:
    $$1100101 \oplus 0110100$$
    $$1100101 \wedge (0110100 \vee 1100101)$$

    $$\mathbf{1100101 \oplus 0110100 = 1010001}$$

    $$\mathbf{1100101 \wedge (0110100 \vee 1100101) = 1100101 \wedge 1110101}$$
    $$\mathbf{= 1100101}$$

3. (4 points) In the island of knights and knaves created by Smullyan, determine, if possible, what *A* and *B* are if *A* says "We are both knaves" and *B* says nothing.

Assume that A is a knight. Then his statement: "We are both knaves" should be true, which is impossible since he is not knave.
Now, assume that A is a knave. Then, his statement "We are both knaves" is false. This means that either one of them is a knave or both are knights. However, since A is a knave, then B must be a knight, which is the only option.
Therefore, A is a knave and B is a knight.

4. (6 points) Construct a combinatorial circuit using inverters, OR gates and AND gates that produces the output $(p \wedge \neg r) \vee \neg(r \wedge \neg q)$.