University of Central Punjab

(Faisalabad Campus)

Semester: Fall 2019

Subject: Discrete Structures

Instructor: Aized Amin Soofi

Assignment #1

1. Which of these are propositions? What are the truth values of those that are propositions?

a) Do not pass go.

b) What time is it?

c) There are no black flies in Maine.

d) $4 + x = 5$.

e) The moon is made of green cheese.

f) $2n \geq 100$.

2. What is the negation of each of these propositions?

a) Jennifer and Teja are friends.

b) There are 13 items in a baker's dozen.

c) Abby sent more than 100 text messages every day.

d) 121 is a perfect square.

3. Suppose that SmartphoneAhas 256MBRAMand 32GB ROM, and the resolution of its camera is 8 MP; Smartphone B has 288 MB RAM and 64 GB ROM, and the resolution of its camera is 4 MP; and Smartphone C has 128 MB RAM and 32 GB ROM, and the resolution of its camera is 5 MP. Determine the truth value of each of these propositions.

a) Smartphone B has the most RAM of these three smartphones.

b) Smartphone C has more ROM or a higher resolution camera than Smartphone B.

c) Smartphone B has more RAM, more ROM, and a higher resolution camera than Smartphone A.

d) If Smartphone B has more RAM and more ROM than Smartphone C, then it also has a higher resolution camera.

e) Smartphone A has more RAM than Smartphone B if and only if Smartphone B has more RAM than Smartphone A.

4. Let p and q be the propositions

p : I bought a lottery ticket this week.

q : I won the million dollar jackpot.

Express each of these propositions as an English sentence.

a) $\neg p$

b) $p \vee q$

c) $p \rightarrow q$

d) $p \wedge q$

e) $p \leftrightarrow q$

f) $\neg p \rightarrow \neg q$

g) $\neg p \wedge \neg q$ h) $\neg p \vee (p \wedge q)$

5. Let p and q be the propositions "The election is decided" and "The votes have been counted," respectively. Express each of these compound propositions as an English sentence.

a) $\neg p$

b) $p \vee q$

c) $\neg p \wedge q$

d) $q \rightarrow p$

e) $\neg q \rightarrow \neg p$

f) $\neg p \rightarrow \neg q$

g) $p \leftrightarrow q$

h) $\neg q \vee (\neg p \wedge q)$

6. Let p, q, and r be the propositions

p :You have the flu.

q :You miss the final examination.

r :You pass the course.

Express each of these propositions as an English sentence.

a) $p \rightarrow q$

b) $\neg q \leftrightarrow r$

c) $q \rightarrow \neg r$

d) $p \vee q \vee r$

e) $(p \rightarrow \neg r) \vee (q \rightarrow \neg r)$

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

7. Let p, q, and r be the propositions

p :You get an A on the final exam.

q :You do every exercise in this book.

r :You get an A in this class.

Write these propositions using p, q, and r and logical connectives (including negations).

a) You get an A in this class, but you do not do every exercise in this book.

b) You get an A on the final, you do every exercise in this book, and you get an A in this class.

c) To get an A in this class, it is necessary for you to get an A on the final.

d) You get an A on the final, but you don't do every exercise in this book; nevertheless, you get an A in this class.

e) Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class.

f) You will get an A in this class if and only if you either do every exercise in this book or you get an A on the final.

8. Determine whether each of these conditional statements is true or false.

a) If 1 + 1 = 3, then unicorns exist.
b) If 1 + 1 = 3, then dogs can fly.
c) If 1 + 1 = 2, then dogs can fly.
d) If 2 + 2 = 4, then 1 + 2 = 3.

9. Construct a truth table for each of these compound propositions.

a) $p \rightarrow \neg p$
b) $p \leftrightarrow \neg p$
c) $p \oplus (p \vee q)$
d) $(p \wedge q) \rightarrow (p \vee q)$
e) $(q \rightarrow \neg p) \leftrightarrow (p \leftrightarrow q)$
f) $(p \leftrightarrow q) \oplus (p \leftrightarrow \neg q)$

10. Construct a truth table for each of these compound propositions.

a) $p \oplus p$
b) $p \oplus \neg p$
c) $p \oplus \neg q$
d) $\neg p \oplus \neg q$
e) $(p \oplus q) \vee (p \oplus \neg q)$
f) $(p \oplus q) \wedge (p \oplus \neg q)$

11. Construct a truth table for each of these compound propositions.

a) $(p \vee q) \vee r$
b) $(p \vee q) \wedge r$
c) $(p \wedge q) \vee r$
d) $(p \wedge q) \wedge r$
e) $(p \vee q) \wedge \neg r$
f) $(p \wedge q) \vee \neg r$

12. For each of these sentences, determine whether an inclusive or, or an exclusive or, is intended. Explain your answer.

a) Experience with C++ or Java is required.
b) Lunch includes soup or salad.
c) To enter the country you need a passport or a voter registration card.
d) Publish or perish.

13. For each of these sentences, state what the sentence means if the logical connective or is an inclusive or (that is, a disjunction)versus an exclusive or. Which of these meanings of or do you think is intended?

a) To take discrete mathematics, you must have taken calculus or a course in computer science.
b) When you buy a newcar fromAcme Motor Company, you get $2000 back in cash or a 2% car loan.
c) Dinner for two includes two items from column A or three items from column B.
d) School is closed if more than 2 feet of snow falls or if the wind chill is below −100.

14. Write each of these statements in the form “if p, then q” in English.
a) It is necessary to wash the boss’s car to get promoted.
b) Winds from the south imply a spring thaw.
c) A sufficient condition for the warranty to be good is that you bought the computer less than a year ago.
d) Willy gets caught whenever he cheats.
e) You can access the website only if you pay a subscription fee.
f) Getting elected follows from knowing the right people.
g) Carol gets seasick whenever she is on a boat.