ASHESI

Discrete Structures and Theory (Spring 2023)
Discussion 1
Date: 19/01/2023

1. Which of these are propositions?
   a) Do not pass go.
   b) What time is it?
   c) There are no black flies in Maine.
   d) $4 + x = 5$.

2. What is the negation of each of these propositions?
   a) Mei has an MP3 player.
   b) There is no pollution in New Jersey.
   c) $2 + 1 = 3$.
   d) The summer in Maine is hot and sunny.

3. Suppose that:
   Smartphone A has 256 MB RAM and 32 GB 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 "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) $\neg q \vee (\neg p \wedge q)$

5. Let p and q be the propositions
   p: "You drive over 65 miles per hour."
   q: "You get a speeding ticket."
   Write these propositions using p and q and logical connectives (including negations).
   a) You do not drive over 65 miles per hour.
   b) You drive over 65 miles per hour, but you do not get a speeding ticket.
   c) You will get a speeding ticket if you drive over 65 miles per hour.

d) If you do not drive over 65 miles per hour, then you will not get a speeding ticket.
e) Driving over 65 miles per hour is sufficient for getting a speeding ticket.
f) You get a speeding ticket, but you do not drive over 65 miles per hour.
g) Whenever you get a speeding ticket, you are driving over 65 miles per hour.

6. 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 $2 + 2 = 4$.
   c) If $1 + 1 = 2$, then dogs can fly.
   d) If $2 + 2 = 4$, then $1 + 2 = 3$.

7. For each of these sentences, determine whether an inclusive or, or an exclusive or, is intended.
   a) To take discrete mathematics, you must have taken calculus or a course in computer science.
   b) When you buy a new car from Acme 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.

8. Write each of these statements in the form "if p, then q" inEnglish.
   a) I will remember to send you the address only if you send me an e-mail message.
   b) To be a citizen of this country, it is sufficient that you were born in the United States.
   c) If you keep your textbook, it will be a useful reference in your future courses.
   d) The Red Wings will win the Stanley Cup if their goalie plays well.
   e) That you get the job implies that you had the best credentials.
   f) The beach erodes whenever there is a storm.
   g) It is necessary to have a valid password to log on to the server.
   h) You will reach the summit unless you begin your climb too late.