CS 205 - Problem Set 1 - Propositions

Sections 1-3, 7-9

Due Date, Sunday September 18, 2022 by midnight

Instructions

- Read Rosen 1.1, 1.2 prior to completing this problem set OR
- Watch videos on foundations of logic - on cubits
- Write/type solution to each problem on a new page
- Combine all solutions to create a single PDF
- Submit your solutions to gradescope
- You are authorized to seek help from course staff ONLY
- If you have any questions about a specific problem, post the question to canvas discussions

your work may not be graded without you signing below

I certify that this paper represents my own work and I have read RU academic integrity policies https://www.cs.rutgers.edu/academic-integrity/introduction

sign your name: Akshaj Kammari

PRINT your name: Akshaj

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Recitation-1-3, 7-9: 7

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Problem 1

1. Check to see if the statement $n^2 + n + 41$ is prime for $n = 0, 1, \ldots, 5$. Complete the table below.

n	value	isPrime
0	41	YES
1	43	YES
2	47	YES
3	53	YES
4	61	YES
5	71	YES

2. If that all values in the above table are all prime, can you make a general statement that $n^2 + n + 41$ is prime for all natural numbers n? Why or why not? If answer is no, give an example of n such that expression is not prime or if the answer is yes, provide a brief justification.

Your answer

$n^2 + n + 41$ is not prime for all natural numbers n. when n is 41 the expression is not prime.

Problem 2

Let p, q be the propositions,

- p: course grades have been finalized
- q: final exam has been graded

Express the following propositions in English. Please be as clear and as concise as possible.

1. $p \Rightarrow q$

   If course grades have been finalized, then final exam has been graded

2. $p \vee \neg q$

   Course grades have been finalized, or final exam has not been graded

3. $\neg q \Rightarrow \neg p$

   If final exam has not been graded, then course grades have not been finalized

4. $\neg q \vee (\neg p \wedge q)$

   Final exam has not been graded, or course grades have not been finalized and final exam has been graded

Problem 3

Let p, q, r be the propositions,

- p: You win the primary
- q: You visit every home in your district.
- r: You win the election

Express the following expressions using notation. Please provide the answer using p, q and r.

1. You win the election, but you do not visit every home in your district.

   $r \wedge \neg q$

2. You win the primary, and you visit every home in your district, and therefore you win the election.

   $(p \wedge q) \Rightarrow r$

3. To win the election, it is necessary for you to visit every home in the district.

   $r \Rightarrow q$

4. You win the primary, but you don't visit every home in your district, nevertheless you win the election

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

5. You will win the election if and only if you either visit every house in the district or you win the primary

   $r \Leftrightarrow (q \vee p)$

6. You don't win election unless you visit every home in your district

   $\neg q \Rightarrow \neg r$

$p \Rightarrow q$ is $\neg p \vee q$

Problem 4

Are these statements consistent?

- Whenever the road is being repaired, people cannot access the grocery store. $p \Rightarrow \neg q$
- If people can access the grocery store, then they can buy some food. $q \Rightarrow r$
- If people cannot buy some food, then the road is being repaired $\neg r \Rightarrow p$

Show all your work. Be as brief and as concise as possible.

Your answer

p = the road is being repaired
q = people can access the grocery store
r = people can buy some food

These statements ARE consistent.

p	q	r	$\neg p \vee \neg q$	$\neg q \vee r$	$r \vee p$
T	T	T	F	T	T
T	T	F	F	F	T
T	F	T	T	T	T
T	F	F	T	T	T
F	T	T	T	T	T
F	T	F	T	F	F
F	F	T	T	T	T
F	F	F	T	T	F

Problem 5

An explorer is captured by a group of cannibals. There are two types of cannibals—***those who always tell the truth and those who always lie***. The cannibals will barbecue the explorer unless explorer can determine whether a particular cannibal always lies or always tells the truth. Explorer is allowed to ask the cannibal exactly one question.

1. Explain why the question "Are you a liar?" does not work.
2. Find a question that the explorer can use to determine whether the cannibal always lies or always tells the truth.

Show all your work. Be as brief and as concise as possible.

Your answer

1. Because both types of cannibals will answer with "no".
2. Are you a cannibal?