

CSCE 222 [505] Discrete Structures for Computing
Fall 2015 – Philip C. Ritchey

Problem Set 1

Due dates: Electronic submission of \LaTeX and PDF files of this homework is due on **9 September 2015 (Wednesday) before 11:30 a.m.** on eCampus (<http://ecampus.tamu.edu>).

| Name | Problems |
|----------------|----------|
| Mitesh Patel | 1–10 |
| UIN: 124002210 | |
| Date: 9-9-15 | |

Resources. Peer Teachers HRBB 129, Discrete Mathematics and Its Applications by Rosen, Piazza, sharelatex.com.

Problem 1. (10 points) Supplementary Exercise 2

Solution. :

Truth Table: $(p \vee q) \rightarrow (p \wedge \neg r)$

| p | q | r | $\neg r$ | $p \vee q$ | $p \wedge \neg r$ | $(p \vee q) \rightarrow (p \wedge \neg r)$ |
|---|---|---|----------|------------|-------------------|--|
| T | T | T | F | T | F | F |
| T | T | F | T | T | T | T |
| T | F | T | F | T | F | F |
| T | F | F | T | T | T | T |
| F | T | T | F | T | F | F |
| F | T | F | T | T | F | F |
| F | F | T | F | F | F | T |
| F | F | F | T | F | F | T |

Problem 2. (10 points) Supplementary Exercise 4

Solution. :

A) Converse: If I drive to work, then it is raining today.

Contrapositive: If I don't drive to work, then it is not raining today.

Inverse: If it is not raining today, then I will not drive to work.

B) Converse: If x is greater than or equal to 0, then the absolute value of x is equal to x .

Contrapositive: If x is less than or equal to 0, then the absolute value of x is not equal to x .

Inverse: If the absolute value of x is not equal to x , then x is less than or equal to 0.

C) Converse: If n^2 is greater than 9, then n is greater than 3.

Contrapositive: If n^2 is not greater than 9, then n is not greater than 3.

Inverse: If n is not greater than 3, then n^2 is not greater than 9.

Problem 3. (10 points) Supplementary Exercise 8

Solution. :

A = "If Sergei takes the job offer."

B= "He will get a signing bonus."

C="He will receive a higher salary."

1) $A \rightarrow B$ ——— A is T, B is T

2) $A \rightarrow C$ ——— A is T, C is T

3) $B \rightarrow \neg C$ ——— INCONSISTENT because B is T and C is F

4) A ——— A is T

Problem 4. (10 points) Supplementary Exercise 10

Solution. :

Possible when $p \rightarrow q$ is true, when $\neg(p \vee r) \vee q$ is true, and when q is true.

| p | q | r | $p \rightarrow q$ | $\neg(p \vee r) \vee q$ |
|---|---|---|-------------------|-------------------------|
| T | T | T | T | T |
| T | T | F | T | T |
| T | F | T | F | F |
| T | F | F | F | T |
| F | T | T | T | T |
| F | T | F | T | T |
| F | F | T | T | T |
| F | F | F | T | F |

By constructing a truth table, it helps us understand which possibilities where the student will pass the test. For the student to past the test the propositions in the problem have to be true as stated above. So by looking at rows 1, 2, 5, and 6 we can conclude that 4 out of 8 sequences where the student will pass the test.

Problem 5. (10 points) Supplementary Exercise 14

Solution. :

****MUST KNOW THAT ALL KNAVES ARE LIARS FROM THE TEXT-BOOK (Page 19)**

Anita is a knave, and therefore Borris is not a knight because knaves lie. And if Carmen was a knight then Borris's statement would be true, but Borris's statement is false since we know at least two of them are knaves including Borris which is a liar since he is a knave.

Problem 6. (10 points) Supplementary Exercise 18

Solution. :

P_i = True whenever i is odd and false whenever I is even.

Using this information...

$$\bigvee_{i=1}^{100} (P_i \wedge P_{i+1}) = (P_1 \wedge P_2) \vee (P_2 \wedge P_3) \vee (P_3 \wedge P_4) \dots = F \vee F \vee F = \text{FALSE}$$

$$\bigwedge_{i=1}^{100} (P_i \vee P_{i+1}) = (P_1 \vee P_2) \wedge (P_2 \vee P_3) \wedge (P_3 \vee P_4) \dots = T \wedge T \wedge T = \text{TRUE}$$

Problem 7. (10 points) Supplementary Exercise 20

Solution. :

$P(x)$ = "Student x knows calculus."

$Q(x)$ = "Class y contains a student who knows calculus."

A) $\exists x P(x)$

B) $\neg \forall x P(x)$

C) $\forall y Q(y)$

D) $\forall x P(x)$

E) $\exists y \neg Q(y)$

Problem 8. (10 points) Supplementary Exercise 26

Solution. :

A) $\exists_0 x (x^2 = -1)$ is TRUE because there exactly 0 values that can satisfy the statement

B) $\exists_1 x (|x| = 0)$ is TRUE because there exactly 1 value that can satisfy the statement (0).

C) $\exists_2 x (x^2 = 2)$ is FALSE because there exactly 0 values that can satisfy the statement.

D) $\exists_3 x (x = |x|)$ is FALSE because because more than three values can satisfy that statement.

Problem 9. (10 points) Supplementary Exercise 32

Solution. :

- A) If it does not snow today, then I will not go skiing tomorrow.
- B) Not every person in the class understands mathematical induction.
- C) Every student in the class likes discrete mathematics.
- D) There is a math class in which no student falls asleep during lectures.

Problem 10. (10 points) Supplementary Exercise 38

Solution. :

Prove the contrapositive: If x^3 is rational then x is rational.

so, $x = p / q$, p and q are integers and q is not equal to 0.

then, $x^3 = p^3 / q^3$, p^3 and q^3 are integers, so in conclusion x^3 is rational.

Wildcard Quiz Problems (the quiz on Friday could also be one of these)

Supplementary Exercise 6

Supplementary Exercise 24

Supplementary Exercise 34

Supplementary Exercise 46

Aggie Honor Statement: On my honor, as an Aggie, I have neither given nor received any unauthorized aid on any portion of the academic work included in this assignment. Furthermore, I have disclosed all resources (people, books, web sites, etc.) that have been used to prepare this homework.

Checklist:

1. Did you type your full name and UIN and those of any collaborators?
2. Did you abide by the Aggie Honor Code?
3. Did you solve all problems and start a new page for each?
4. Did you submit
 - (a) your \LaTeX source file?
 - (b) your PDF file?