CSE 211: Discrete Mathematics **(Due: 30/10/22)**

Homework #1

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Course Policy: Read all the instructions below carefully before you start working on the assignment, and before you make a submission.

- It is not a group homework. Do not share your answers to anyone in any circumstance. Any cheating means at least -100 for both sides.
- Do not take any information from Internet.
- No late homework will be accepted.
- For any questions about the homework, send an email to bkarakas2018@gtu.edu.tr
- Use LaTeX. You can work on the tex file shared with you in the assignment document.
- Submit both the tex and pdf files into Homework1. Name of the files should be "*SurnameName_Id.tex*" and "*SurnameName_Id.pdf*".

Problem 1: Sets (3+3+3+3+3=15 points)

Which of the following sets are equal? Show your work step by step.

(a) {t : t is a root of x^2 – 6x + 8 = 0}

(b) {y : y is a real number in the closed interval [2, 3]}

(c) {4, 2, 5, 4}

(d) {4, 5, 7, 2} - {5, 7}

(e) {q: q is either the number of sides of a rectangle or the number of digits in any integer between 11 and 99}

(Solution)

Problem 2: Cardinality of Sets (2+2+2+2=8 points)

What is the cardinality of each of these sets? Explain your answers.

(a) $\{\emptyset\}$

(b) $\{\emptyset, \{\emptyset\}\}$

(c) $\{\emptyset, \{\emptyset, \{\emptyset\}\}\}$

(d) $\{\emptyset, \{\emptyset, \{\emptyset, \{\emptyset\}\}\}\}$

(Solution)

Problem 3: Cartesian Product of Sets (15 points)

Explain why $(A \times B) \times (C \times D)$ and $A \times (B \times C) \times D$ are not the same.

(Solution)

Problem 4: Cartesian Product of Sets in Algorithms (25 points)

Let A, B and C be sets which have different cardinalities. Let (p, q, r) be each triple of A × B × C where p ∈ A, q ∈ B and r ∈ C. Design an algorithm which finds all the triples that are satisfying the criteria: p ≤ q and q ≥ r. Write the pseudo code of the algorithm in your solution.

For example: Let the set A, B and C be as A = { 3, 5, 7 }, B = { 3, 6 } and C = { 4, 6, 9 }. Then the output should be : { (3, 6, 4), (3, 6, 6), (5, 6, 4), (5, 6, 6) }.

(Note: Assume that you have sets of A, B, C as an input argument.)

(Solution)

Algorithm 1: Pseudo Code of Your Algorithm

Input: The sets of A, B, C
if *write a condition* **then**
| Statements
else
| Statements
end
When you want to write a for loop, you can use:
for *write a condition* **do**
end
When you want to write a while loop, you can use:
while *write a condition* **do**
| If you need to return, use **return**
end
For any additional things you have to do while writing your pseudo code, Google "How to use algorithm2e in Latex?".

Problem 5: Functions (16 points)

If f and f ∘ g are one-to-one, does it follow that g is one-to-one? Justify your answer.

(Solution)

Problem 6: Functions (7+7+7=21 points)

Determine whether the function $f : \mathbb{Z} \times \mathbb{Z} \to \mathbb{Z}$ is onto if

(a) $f(m, n) = 2m - n$

(b) $f(m, n) = m^2 - n^2$

(c) $f(m, n) =\mid m \mid - \mid n \mid$

(Solution)

Problem 7: Functions (Bonus 20 points)

Suppose that f is a function from A to B, where A and B are finite sets with $\mid A \mid = \mid B \mid$. Show that f is one-to-one if and only if it is onto.

(Solution)