

OIT 103 - Assignment 1. Do all of the following problems:

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1 Problem 1

Given 3 sets A , B and C . Use Venn diagrams and write explanations as you go, to illustrate the following identities:

1) $(A \cap B) \cap C = A \cap (B \cap C)$

2) $(A \cup B) \cup C = A \cup (B \cup C)$

3) $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$

4) $(A \cap B) \cup C = (A \cup C) \cap (B \cup C)$

2 Problem 2

Use Venn diagrams to see if the conclusions (marked in **boldface**) below are correct. Draw the diagrams and state whether the conclusion is true or false:

First Situation

"All my banana leaf baskets are old."

"The only new things that I haven't bought for myself are your gifts to me"

"You didn't give me any banana leaf baskets"

Second Situation

"My cat Francina only had red kittens, but all my other cats also had grey kittens"

"The kittens I just gave to you are grey"

"I gave you one of Francina's kittens"

Third Situation

"None of the people who ride with the dala-dala at 8 am are from Iringa"

"I met a person from Iringa in the dala-dala this morning"

"I didn't take the 8 am dala-dala."

3 Problem 3

Use the principle of inclusion-exclusion to count the following groups of students:

Part 1:

There are 30 math students in all.

15 math students take a course in numerical methods.

15 math students take a course in logic.

15 math students take a course in basic accountancy.

10 students take courses in logic and numerical methods.

10 students take courses in logic and basic accountancy.

10 students take courses in numerical methods.

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1) How many math students take all 3 courses?

Part 2:

There are 40 science students.

15 science students take a course in biology.

15 science students take a course in chemistry.

20 science students take a course in physics.

20 science students take a course in biology and a course in chemistry.

10 science students take a course in physics and a course in chemistry.

25 science students take all 3 courses.

2) How many science students take a course in biology and a course in physics?

4 Problem 4

Use the principle of mathematical induction to prove the following:

1) $(ab)^n = a^n b^n$ (Here, it's the exponent n you must use induction on).

2) $\sum_{i=1}^n (n^2 - n) = \frac{n^3 - n}{3}$

5 Problem 5

Give definitions of the following concepts. You may look things up on the internet or in a textbook. If you feel more comfortable with it, you may also draw pictures as long as you write some text, too:

- 1) Set and element of a set.
- 2) Union and intersection of sets.
- 3) De Morgan's Laws.
- 4) The use of Venn diagrams in logical arguments.
- 5) The inclusion-exclusion counting principle.
- 6) Mathematical induction.