

# ICS 6B F23 Take Home Exam 4

Due: October 27th, 2023 at 11:59PM

Name: \_\_\_\_\_

UCI NetID : 

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(alpha-numeric; NOT your student ID)

- Read the instructions of each question carefully.
- All problems will have a "What to show" section that will describe exactly what work is expected of you we solving the problem. Failure to meet the requirements of the "What to show" sections will result in a Not Yet. If you have questions about what to show please ask on Ed.
- An answer where thought process is unclear will be given a grade of Not Yet
- Your submission should follow the template exactly. Any insertion, removal, or reordering of pages from the original template may result in readers not grading certain problems. In such an event you will receive "Not Yet" and no feedback on the problems in question.
- Place your answers in the boxed regions. Writing outside of the boxes will not be considered as part of your answers.
- This exam will cover the Outcomes from the S Learning Objective
- Please keep in mind of the academic honesty guidelines. This take-home exam is to be **completed individually, with no outside help**. You may use any resources from our class (ZyBooks and resources from Canvas), but you may not use any other online resources.
- You may choose to print the exam or use a digital editor for completing the exam. It is required that you use this PDF to complete your work. If you have no access to a printer or digital tools to fulfill the exam, feel free to reach out to the staffs regarding your concern.
- If you have any questions, please post a private Ed or attend available Office Hours. Note that we are not allowed to provide specific help to answering the exam questions.

## Problem 1.1 (S1)

- a) Express the set of prime integers greater than 20 and less than 30 using roster notation.  
 b) Express this set  $\{1, 4, 9, 16, 25, 36, 49\}$  using set builder notation.

**What you need to show:** For each of the two parts, writing down the answer is sufficient. No need to explain.

## Problem 1.2 (S1)

Let  $P = \{c, b, a, \{a\}, \{c, b\}, \{a, b, c, d\}\}$  and  $Q = \{a, b, c, \{a\}, \{b, c\}, \{a, b, c, d\}\}$ .

Determine the truth value of the following statements:

- a)  $P = Q$   
 b)  $\{a, b\} \in P$   
 c)  $\{c, b\} \subset Q$

**What you need to show:** For each of the three parts, state the truth value and briefly (a sentence or two) explain why.

## Problem 2.1 (S2)

Sets  $A, B, C$  and  $D$  are defined below and assume the universal set is the set of integers,  $\mathbb{Z}$ :

$$A = \{x \in \mathbb{Z} : x \text{ is a multiple of } 3\}$$

$$B = \{-3, 0, 2, 3, 5, 6\}$$

$$C = \{x \in \mathbb{Z} : x \text{ is a prime number less than } 10\}$$

$$D = \{a, b\}$$

For each of the following sets, express it in roster notation and write down the cardinality of it:

- a)  $(A \cap B) \cup C$   
 b)  $\overline{A} \cap (B \cup C)$   
 c)  $(B \cap C) \times D$

**What you need to show:** For each of the three parts, writing down the answer is sufficient. No need to explain.

## Problem 2.2 (S2)

The set subtraction law states that  $A - B = A \cap \overline{B}$ . Use the set subtraction law as well as the other set identities given in the table to prove  $A - (B \cup C) = (A - B) \cap (A - C)$ .

**What you need to show:** Label each step in your proof with the set identity used to establish that step.

### Problem 3 (S3)

There are 300 students in the school. Determine whether the given subsets form partitions or not. Note that for a sequence of sets  $A_1, A_2, \dots, A_n$  to be a partition of  $A$ , they need to satisfy the following 4 properties:

- Property 1:  $\forall i, A_i \subseteq A$
- Property 2:  $\forall i, A_i \neq \emptyset$
- Property 3:  $A_1, A_2, \dots, A_n$  are pairwise disjoint
- Property 4:  $A = A_1 \cup A_2 \cup \dots \cup A_n$

a) There are different school clubs (e.g., chess club, drama club, science club). Consider a subset of students for each club. Assume some students are members of multiple clubs and every student is in at least one club.

b) There was a big opening ceremony for all students where attendees could get a souvenir. Consider a subset of students for each type of souvenir. Unfortunately, 10 students were absent for some reason.

**What you need to show:** For each part, explicitly state which property of a partition has been violated and briefly (one or two sentences) explain why.