

CSCI 246: Test 1 (10 points)

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This is an open-book, open-notes test. Any personal help is a **plagiarism**. Tentatively, this test starts at 4pm and ends at 5:15pm. If you are doing it on-line, after you finish, scan a pdf file on D2L under "Assignments/Test.1".

Problem 1

Let $S = \{a, b, 1, 2\}$. List the power set (set of all the subsets) of S .

$$\mathcal{P}(S) = \{ \emptyset, \{a\}, \{b\}, \{1\}, \{2\}, \{a, b\}, \{a, 1\}, \{a, 2\}, \\ \{b, 1\}, \{b, 2\}, \{1, 2\}, \{a, b, 1\}, \{a, b, 2\}, \{a, 1, 2\}, \\ \{b, 1, 2\}, \{a, b, 1, 2\} \}$$

Problem 2

Write the negation, contrapositive, converse, and inverse for the following statement.

If x is divisible by 18, then x is divisible by 9 and x is divisible by 2.

(2.1) Negation

x is divisible by 18, and x is not divisible by 9 or x is not divisible by 2.

(2.2) Contrapositive

$\forall x$, if x is not divisible by 9 or x is not divisible by 2, then x is not divisible by 18.

(2.3) Converse

$\forall x$, if x is divisible by 9 and x is divisible by 2, then x is divisible by 18.

(2.4) Inverse

$\forall x$, if x is not divisible by 18, then x is not divisible by 9 or x is not divisible by 2

Problem 3

Use universal modus tollens to fill in a valid conclusion for the following argument.

If a computer program is correct, then compilation of the program does not produce error messages.

Compilation of this program produces error messages.

\therefore This computer program is not correct.

Problem 4

The logician Raymond Smullyan describes an island containing two types of people: knights who always tell the truth and knaves who always lie. You are visiting the island and have the following encounters with natives.

Two natives A and B address you as follows.

A says: B is a knave.

B says: A and I are of the same type (i.e., both are knaves or both are knights).

What are A and B ?

If A is a knave, then B is a knight, but they are not the same type, so A is a knight.

With A as a knight, B is a knave, so they are not of the same type and all conditions are met.

A - knight
B - knave

Problem 5

(5.1) Write a negation for the statement:

\exists integer d , if $\frac{18}{d}$ is an integer then $d = 3$.

\forall integer d , such that $\frac{18}{d}$ is an integer but $d \neq 3$

(5.2) Is the statement in (5.1) correct? Explain the reason.

Incorrect. $d=6$ is a counterexample $\frac{18}{6} = 3$ $d=6 \neq 3$