

In Class Problem Set #1

CSE 1400 and MTH 2051

Fall 2012

Instructions

1. Join the other students who share your number.
2. Introduce yourselves to each other.
3. As a group, complete as many of the problems as you can and record your answers.
4. Be certain each member of your group understands the answer and that you all agree it is correct.
5. If you cannot solve some problem, mark it for later thought and move to the next problem.
6. Complete all problems (with your group, by yourself, or with others) before the next class.

Basic Logic

1. Consider the four statements (propositions). Which propositions are True and which are False?
 - (a) $32 - 6 = 16$
Answer: This proposition is False: $32 - 6 = 26$ is True
 - (b) There is a one-to-one correspondence between two-bit binary strings and the corners of a square.
Answer: This proposition is True: Think of a square with corners at $(0, 0)$, $(1, 0)$, $(1, 1)$, $(0, 1)$
 - (c) If x is a real number and $x^2 > 4$, then $x < -2$ or $x > 2$.
Answer: This proposition is True. A basic algebra problem.
 - (d) If n is an integer and n^2 is even, then n is even.
Answer: This proposition is True. (If n is odd, then n^2 is odd.)
2. A proposition is a sentence that is either True or False. Which of the following are propositions and which are not?
 - (a) $x^2 - x - 1 = 0$.
Answer: This is not a proposition. It is a predicate: whether it is True or False is predicated on the value of x .
 - (b) There is a real number x such that $x^2 - x - 1 = 0$.
Answer: This is a proposition. One value of x that satisfies the equation is the golden ratio $(1 + \sqrt{5})/2$.
 - (c) Is it raining outside?
Answer: This is not a proposition. It is a question, not a statement.
 - (d) $5 + 4$.
 - (e) All babies are afraid of crocodiles.
Answer: This is a proposition, but I don't know how you can compute its truth value.
3. Let variables P , Q and R represent the truth values of four propositions. Suppose that $P = \text{True}$, $Q = \text{False}$, and $R = \text{True}$. What are the truth values of the following propositions?

(a) P and Q

Answer: True and False is False

(b) P or Q

Answer: True or False is True

(c) Not R

Answer: Not True is False

(d) P or Q , but not both (exclusive or)

Answer: True exclusive or False is True

(e) P is equivalent to Q

Answer: True is equivalent to False is False

(f) P is equivalent to R

Answer: True is equivalent to True is True

(g) $(P$ or $Q)$ and R

Answer: (True or False) and True is True

(h) $(P$ and $Q)$ or R

Answer: (True and False) or True is True

(i) if P then Q

Answer: if True then False is False

(j) if P then R

Answer: if True then True is True

(k) if Q then P

Answer: if False then True is True

(l) if Q then Q

Answer: if False then False is True