SET Homework

Solve the 4 HW problems. Due time: Feb 11, Tuesday 8:15.

You can get extra credit for the solutions of extra problems. You can submit the solutions of at most 2 extra problems weekly. Groups can submit joint solutions for shared credit. The extra problems do not have due time.

HW problems

Problem 1.2. Decide which sentences are propositions?

(1) Toronto is the capital of Canada.
(2) $2 + 2 = 4$.
(3) Read this carefully.
(4) $x + y = z$.

Problem 1.7. Prove the following distributive law: if p, q and r are propositions, then

$$p \vee (q \wedge r) \Longleftrightarrow (p \vee q) \wedge (p \vee r).$$

Problem 1.12. Let p, q, and r be the propositions

p : Grizzly bears have been seen in the area.
q : Hiking is safe on the trail.
r : Berries are ripe along the trail.

Write these propositions using p, q, and r and logical connectives.

a) Berries are ripe along the trail, but grizzly bears have not been seen in the area.

b) Grizzly bears have not been seen in the area and hiking on the trail is safe, but berries are ripe along the trail.

c) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.

d) It is not safe to hike on the trail, but grizzly bears have not been seen in the area and the berries along the trail are ripe.

e) For hiking on the trail to be safe, it is necessary but not sufficient that berries not be ripe along the trail and for grizzly bears not to have been seen in the area.

f) Hiking is not safe on the trail whenever grizzly bears have been seen in the area and berries are ripe along the trail. □

Problem 1.29. Let $M(x, y)$ be "*x has sent y an e-mail message*" and $T(x, y)$ be "*x has telephoned y*", where the domain consists of all students in your class. Use quantifiers to express each of these statements. (Assume that all e-mail messages that were sent are received, which is not the way things often work.)

a) Chou has never sent an e-mail message to Koko.

b) Arlene has never sent an e-mail message to or telephoned Sarah.

c) José has never received an e-mail message from Deborah.

d) Every student in your class has sent an e-mail message to Ken.

e) No one in your class has telephoned Nina.

f) Everyone in your class has either telephoned Avi or sent him an e-mail message.

g) There is a student in your class who has sent everyone else in your class an e-mail message.

h) There is someone in your class who has either sent an e-mail message or telephoned everyone else in your class.

i) There are two different students in your class who have sent each other e-mail messages.

j) There is a student who has sent himself or herself an e-mail message. □

Extra HW problems

Problem 1.29. Let $M(x, y)$ be "*x has sent y an e-mail message*" and $T(x, y)$ be "*x has telephoned y*", where the domain consists of all students in your class. Use quantifiers to express each of these statements. (Assume that all e-mail messages that were sent are received, which is not the way things often work.)

k) There is a student in your class who has not received an e-mail message from anyone else in the class and who has not been called by any other student in the class.

l) Every student in the class has either received an e- mail message or received a telephone call from another student in the class.

m) There are at least two students in your class such that one student has sent the other e-mail and the second student has telephoned the first student. □

Problem 1.45. A detective has interviewed four witnesses to a crime. From the stories of the witnesses the detective has concluded that if the butler is telling the truth then so is the cook; the cook and the gardener cannot both be telling the truth; the gardener and the handyman are not both lying; and if the handyman is telling the truth then the cook is lying. For each of the four witnesses, can the detective determine whether that person is telling the truth or lying? Explain your reasoning.