202109 Math 122 Worksheet 1

Due: Wednesday, September 22, 2021 by 23:59 Pacific Time. Please upload your completed assignment to your section's Crowdmark page.

There are three questions worth 7 marks each, plus a bonus question worth 2 bonus marks. Please feel free to discuss these problems with each other. In the end, each person must write up their own solution, in their own words, in a way that reflects their own understanding. Complete solutions are those which are coherently written, and include appropriate justifications. An unjustified answer is only worth marks when the instructions say that no justification is needed.

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1. Everything a very busy and distracted math professor says on Tuesdays, Wednesdays and Sundays is false. Everything he says on Mondays, Thursdays, Fridays and Saturdays is true.

   (a) On which days of the week can he make the statement "*I will make false statements tomorrow*"?

   (b) On which days of the week can he make the statement "*If I am making false statements today, then I will be making false statements tomorrow*"?

   (c) On which days of the week can he make the statement "*I am making true statements today if and only if I made false statements yesterday*"?

2. Suppose the statement $\neg p \leftrightarrow q$ is false. Find all truth values for p, q, r, s such that the statement $\neg(q \vee \neg s) \leftrightarrow (p \wedge \neg r)$ is true.

3. A running coach is heard telling his athletes "*To run the marathon in under 3 hours you need to have successfully completed all of the training sessions and achieved all of the training goals that were set. If you have not successfully completed all of the training sessions and have not achieved all of the training goals that were set, then you can not run the marathon in under 3 hours*". Write the instructions in symbolic form using "r: you can run the marathon in under 3 hours", "s: you have successfully completed all of the training sessions", and "a: you have achieved all of the training goals that were set". Do the two statements in the instructions have the same logical meaning, that is, if either one of them is true then so is the other one?

4. Bonus question, [2 bonus marks]. Gary just bought a set of 7 hockey pucks and laid them out so each one is flat on his desk. Each puck has one side painted with a colour and a photograph of a retired hockey player on the other side. The person who sold him the pucks claims the design obeys the rule "*if a side of a puck is painted blue or orange, then the opposite side has a picture of Hayley Wickenheiser or Paul Henderson.*" When Gary looks at the pucks on his desk he sees red, Cassie Campbell, Bobby Hull, blue, Paul Henderson, orange, and Hayley Wickenheiser, respectively. What is the smallest number of pucks for which he needs to check the bottom side in order to confirm that the rule holds?