

## Discrete Math Group Project #7

10/9/20

*Instructions:* Reports will be due by Monday evening 10/12. Make sure to include a title at the top of your report with the names of all participating team members. If you submit via email, please title your file as "Project7-Team\*.pdf" (where \* indicates your team number).

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### PART I:

Each implication statement " $\mathcal{P} \implies \mathcal{Q}$ " has four associated implications:

- the implication statement: " $\mathcal{P} \implies \mathcal{Q}$ "
- the converse statement: " $\mathcal{Q} \implies \mathcal{P}$ "
- the contrapositive statement: " $\neg \mathcal{Q} \implies \neg \mathcal{P}$ "
- the inverse statement: " $\neg \mathcal{P} \implies \neg \mathcal{Q}$ "

PROBLEM #1. Which of the four statements listed above are logically equivalent, and which are not? Justify your answers by using truth tables (when they are) and a counterexample (when they aren't).

PROBLEM #2. [see sample exam 1] Let  $c$  and  $d$  be positive real numbers. Consider the implication statement: "If  $c + d < 100$  then  $c < 40$  or  $d < 60$ ."

State the (a) converse, (b) contrapositive and (c) inverse of this implication in simplest form.

(d) Give a counterexample showing that at least one of these statements is false.

(e) Are any of the statements true?

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### PART II: [see sample exam 1]

PROBLEM #3. In the integer grid how many sg-paths  $p$  are there starting at  $(0, 0)$  and ending at  $(5, 3)$  such that:

- $p$  passes through the point  $(4, 1)$ .
- $p$  does not pass through the point  $(1, 4)$ .
- $p$  does not contain any points of the form  $(n, n)$  except for  $(0, 0)$ .

Give justification for your answers, and indicate some relevant paths and their associated strings of R's and U's.

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### PART III: From Hammack's book:

PROBLEM #4. Carefully read through section 5.3, pages 133–135 and discuss these points among yourselves, then write down a summary of your reactions to this. Are you confused by any of the comments? Which seem most surprising? Which seem most important? Which are the best take-aways for you?