

Notebook (Proofs Portfolio)

As a culmination of your work these 5 weeks, you will create a notebook containing excellent versions of certain proofs. The first proofs are listed below and I'll add to the list as time goes on.

Guidelines:

- One proof written carefully, correctly and neatly per page.
- These should go into a notebook (something that holds pages and you can remove and add pages).
- The proofs will be evaluated according to the rubric. Only proofs that get a total score of 14 or 15 will be counted.
- You can submit your notebook for early evaluation at any time. Any proofs that don't make the cut can be redone. Corrections must be done from scratch.
- The complete notebook is due by the end of class on Thursday, July 12.

List of problems/proofs:

1. Prove $P \rightarrow Q$ is equivalent to $\neg Q \rightarrow \neg P$. (Use a truth table).
2. Prove that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.
3. Prove $A \setminus (B \cup C) = (A \setminus B) \cap (A \setminus C)$.
4. Prove $(A \setminus B) \cap B = \emptyset$.
5. Prove if $A \subseteq B$ then $A \cup B = B$.
6. Prove that $((A \cap C) \cap B) \cup ((A \cap C) \cap B^c) \cup (A \cap C)^c = U$.
7. Prove if $A \subseteq B$ and $C \subseteq D$ then $A \times C \subseteq B \times D$.
8. Prove that $(A \cap B) \times (C \cap D) = (A \times C) \cap (B \times D)$.
9. Let S be the relation from \mathbf{R} to \mathbf{R} defined by $(x, y) \in S$ iff $y = x^2 - 4x + 9$. Find the domain and range of S and prove that they are in fact the domain and range of S .
10. Let R be a relation from A to B and S a relation from B to C . Prove that $\text{Dom}(S \circ R) \subseteq \text{Dom}(R)$.
11. Prove that Relation P (from the Relations sheet, (m)) is an equivalence relation.
12. Let R and S be relations from A to A , Prove that if R and S are transitive then $R \cap S$ is also transitive.
13. Prove that the relation defined in §4.4#1(c) is a partial order.