# In-Class Problems Week 4, Wed.

**Problem 1.**

| Direct Prerequisites | Subject |
|---|---|
| 18.01 | 6.042 |
| 18.01 | 18.02 |
| 18.01 | 18.03 |
| 8.01 | 8.02 |
| 8.01 | 6.01 |
| 6.042 | 6.046 |
| 18.02, 18.03, 8.02, 6.01 | 6.02 |
| 6.01, 6.042 | 6.006 |
| 6.01 | 6.034 |
| 6.02 | 6.004 |

**(a)** For the above table of MIT subject prerequisites, draw a diagram showing the subject numbers with a line going down to every subject from each of its (direct) prerequisites.

**(b)** Give an example of a collection of sets partially ordered by the proper subset relation, $\subset$, that is isomorphic to ("same shape as") the prerequisite relation among MIT subjects from part (a).

**(c)** Explain why the empty relation is a strict partial order and describe a collection of sets partially ordered by the proper subset relation that is isomorphic to the empty relation on five elements —that is, the relation under which none of the five elements is related to anything.

**(d)** Describe a *simple* collection of sets partially ordered by the proper subset relation that is isomorphic to the "properly contains" relation, $\supset$, on $\mathcal{P}\{1, 2, 3, 4\}$.

**Problem 2.**
A binary relation, $R$, on a set, $A$, is *irreflexive* iff $\text{NOT}(a \ R \ a)$ for all $a \in A$. Prove that if a binary relation on a set is transitive and irreflexive, then it is strict partial order.

**Problem 3.**
How many binary relations are there on the set $\{0, 1\}$?

How many are there that are transitive?, . . . asymmetric?, . . . reflexive?, . . . irreflexive?, . . . strict partial orders?, . . . weak partial orders?

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*Hint:* There are easier ways to find these numbers than listing all the relations and checking which properties each one has.

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