Ma2201/CS2022 **Discrete Mathematics** A Term, MMXVII

Double Down Quiz

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Sign: $\emptyset\Im\Re\nabla\partial\infty\partial\nabla\aleph$

☐ Ordinary Quiz ☒ Double Down ☐ Triple Down

1. (**2 points**) If you order $X = \{1, 2, 3, 4, 5, 6, 7, 8\}$ what are the 78'th, 79'th, and 80'th subsets of X in lexicographic order.

(The 0'th and first elements are $\emptyset$ and $\{1\}$).

♣ *It is easy to compute* 78 *in binary as* 1001110 *so the eight coordinate bit vector is* 01001110 *and the set is* $\{2, 3, 4, 7\}$ *, with the next two following set are* $\{1, 2, 3, 4, 7\}$*, encoded by* 01001111 *and* $\{5, 7\}$*, encoded by* 01010000. ♣

2. (**2 points**) Give a relation on $X = \{1, 2, 3, 4, 5, 6, 7, 8\}$ which is reflexive and transitive but not symmetric.

♣ *There are very many such relations. Easiest to describe is the relation* $\leq$*:*

$$R = \{(a, b) \in X \times X \mid a \leq b\}$$

. ♣

3. (**2 points**) Suppose $X \subseteq \mathbb{R}$ and that X is countably infinite. Let Y be the set $Y = \{A \subset X \mid |A| = 2\}$. Label the following as finite, countably infinite or uncountable:

_____ $X \times Y$

_____ $\mathcal{P}(X \cap Y)$

♣ X *and* Y *are countably infinite, so* $X \times Y$ *is countably infinite.*

For the second one, X *is a set of numbers, and* Y *is a set of sets, so* $X \cap Y = \emptyset$*, so* $\mathcal{P}(X \cap Y) = \mathcal{P}(\emptyset) = \{\emptyset\}$*, which is a finite set.* ♣

4. (**4 points**) Suppose p_i be a statement for all $i \in \mathbb{N}$. Suppose $p_i \Rightarrow p_{i+10}$ for all $i \geq 0$.

Suppose also that $(p_{12} \vee p_{62} \vee p_{602}) \wedge p_{66}$ is true.

Label each of the following as TRUE if you can conclude it is true, FALSE if you can conclude it is false, and ? if it cannot be determined by the given information:

___ $p_{333} \Rightarrow p_{666}$.

___ $p_3 \Rightarrow p_{602}$.

___ $p_{32} \Rightarrow p_{52}$.

___ $p_{1492} \vee p_{1776}$.

♣ *FIRST ONE:* p_{66} *is true, so* p_{666} *is true by induction, hence the consequence of the implication is true, so the implication is TRUE.*

SECOND ONE: $(p_{12} \vee p_{62} \vee p_{602})$ *is true, so either* p_{602} *or* $(p_{12} \vee p_{62})$ *is true in which case* p_{602} *is true by induction. So in either case* p_{602} *is true, so the implication is TRUE.*

THIRD ONE: Since $p_{42} \Rightarrow p_{52}$ *and* $p_{52} \Rightarrow p_{62}$ *are given,* $p_{42} \Rightarrow p_{62}$ *and the statement is TRUE.*

FOURTH ONE: Since p_{66} *is true, so* p_{1776} *is true by induction, so the or statement is TRUE.*

FIFTH ONE: The statement that "Nobody would write a true/fall question with all true answers" is FALSE. ♣