

SRP WORKSHEET 1 ANSWERS

SECTION A

Define: union, intersection, subsethood, power set and Cartesian product. Let M and F be the sets of all males and of all females. Let Rxy be the relation x is older than y and let j denote Johnny.

$$X \cup Y = \{x \mid x \in X \vee x \in Y\}$$

$$X \cap Y = \{x \mid x \in X \wedge x \in Y\}$$

$$X \subseteq Y \leftrightarrow \forall x (x \in X \rightarrow x \in Y)$$

$$\wp(X) = \{Y \mid Y \subseteq X\}$$

$$X \times Y = \{(x, y) \mid x \in X \wedge y \in Y\}$$

(a) Use set-theoretic notation to write down expressions for the following sets:

1. The set of all people who are male or female: $M \cup F$
2. The set of all females younger than Johnny: $F \cap \{x \mid Rjx\}$
3. The set of all sets of males younger than Johnny: $\wp(M \cap \{x \mid Rjx\}) - \{\emptyset\}$
4. The set of all males younger than every female:
 $M \cap \{x \mid \forall z (z \in F \rightarrow Rzx)\}$
5. The set of all possible mixed pairs: $M \times F$
6. The set of all possible mixed pairs involving Johnny: $\{j\} \times F$
7. The set of all possible mixed pairs not involving Johnny:
 $(M \cap \{x \mid \neg x = j\}) \times F$ OR $(M - \{j\}) \times F$

(b) What are the members of $\wp(\wp(\emptyset))$? $\emptyset, \{\emptyset\}$

(c) True or false? $\wp(X) = \wp(Y)$ iff $X = Y$. Say briefly why.

(d) Write down the axiom of extensionality. Say briefly why it follows from the axiom that at most one set is empty.

SECTION B

Say which of the following relations are symmetric, transitive, or reflexive (over some domain of people in which siblings share both parents):

1. Most people prefer x to y $\neg R, \neg S, \neg T$ (Condorcet)
2. x and y are distinct siblings $\neg R, S, \neg T$
3. x is a brother of y $\neg R, \neg S, \neg T$
4. x and y are both alive and x is at least one year older than y
5. x and y are both alive and x is at least 150 years older than y
6. x and y were once married
7. x wrote *Waverley* iff y wrote *Persuasion*

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