

**1. [True or False]**

- (a)  If  $\mathbb{P}(A) > 0$  and  $\mathbb{P}(B) > 0$ , and  $A$  and  $B$  are disjoint, then  $A$  and  $B$  are not independent.
- (b)  If for three events  $A, B$  and  $C$ , it is true that  $\mathbb{P}(A | C) > \mathbb{P}(B | C)$ , then  $\mathbb{P}(A) > \mathbb{P}(B)$ .
- (c)  For independent events  $A$  and  $B$ ,  $\mathbb{P}(A \cup B) = \mathbb{P}(A) + \mathbb{P}(B)$ .

**2. [Short Answer]** Consider the four ace cards (remember, the suits are hearts and diamond, which are red, and spades and clubs, which are black). Melissa shuffles these four cards and draws the top two cards.

- (a) Let  $A$  be the event that Melissa has the ace of hearts. Given  $A$ , what is the probability that Melissa has both red cards?
- (b) Given that Melissa has at least one red card, what is the probability that she has both red cards?
- (c) Give an event  $B$  that is independent of  $A$ .

**3. [Long Answer]** You select a three digit decimal uniformly in  $\{000, 001, \dots, 999\}$  (note that we consider, e.g., 023 to be a three digit decimal number). What is the probability that the number has three identical digits given that it has at least two identical digits?