1. Suppose A and B are two events, where $P(A) = 0.7$, and $P(B) = 0.5$. Briefly justify each part.

(a) **(1 point)** $P(A \cap B) \leq 0.5$

(b) **(1 point)** $P(A \cap B) \geq 0.2$

Solution:

(a) By a theorem, if $A \subset B$, then $P(A) \leq P(B)$. Since $A \cap B \subset B$, we have

$$P(A \cap B) \leq P(B) = 0.5$$

(b) By a theorem, if C is an event, $P(C) \leq 1$. Also, by the additive law of probbaility,

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

Thus, $P(A \cup B) = P(A) + P(B) - P(A \cap B) \leq 1$, which yields

$$P(A \cap B) \geq P(A) + P(B) - 1 = 0.2$$