Answer on Question #66710 – Math – Statistics and Probability

Question

Which of the following statements are true or false? Give reasons for your answers.

(i) If P(A)= 0.4, P(A∪B)=0.7 and A and B are independent sets, then P(B)= 0.55.

(ii) By Chebyschev's inequality, $P\{|x-\mu|\geq 2\sigma\} \leq 0.2$

Solution

(i)

From independence of A and B it follows that

$$P(A \cap B) = P(A)P(B).$$

By inclusion-exclusion principle and by previous statement

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

So we have

$$P(B) = \frac{P(A \cup B) - P(A)}{1 - P(A)} = \frac{0.7 - 0.4}{1 - 0.4} = \frac{0.3}{0.6} = 0.5 \neq 0.55.$$

The statement in the question is false.

(ii)

By Chebyschev's inequality

$$P(|x - \mu| \geq 2\sigma) \leq \frac{\sigma^2}{4\sigma^2} = \frac{1}{4} = 0.25 > 0.2.$$

The statement in the question is false.

Answer:

(i) False.

(ii) False.