Math 3338 Homework Solutions

HW #2

1. Prove Bonferroni's inequality: $P(E \cup F) \geq P(E) + P(F) - 1$

Proof $P(E \cup F) = P(E) + P(F) - P(E \cap F)$

(4) Since $P(E \cap F) \leq 1$, $-P(E \cap F) \geq -1$ so

$P(E \cup F) \geq P(E) + P(F) - 1$.

2. $P(A) = 0.2$ $P(B) = 0.6$. $A \cap B = \emptyset$

Then a. $P(\text{either } A \text{ or } B \text{ occurs}) = P(A \cup B)$

(4) $= P(A) + P(B)$ since $A \cap B = \emptyset$.

$= .2 + .6 = 0.8$

b. $P(A \text{ occurs but } B \text{ does not}) = P(A \cap B^c) = P(A)$

(4) because $A \cap B = \emptyset \Rightarrow A \subset B^c$ so $A \cap B^c = A$.

Then $P(A) = \underline{0.2}$

(4) c. $P(\text{both } A \text{ and } B \text{ occur}) = P(A \cap B) = P(\emptyset) = 0$

3. n socks in drawer; 4 are green. Two socks chosen.

What n makes $P(2 \text{ green socks}) = 1/2$. ?

Solution $P(2 \text{ green socks}) = \dfrac{\binom{4}{2}}{\binom{n}{2}} = \dfrac{6}{\frac{n!}{2!(n-2)!}} = \dfrac{12(n-2)!}{n!}$

(6) $= \dfrac{12}{n(n-1)} = \frac{1}{2}$ if $n^2 - n = 24$

There is no integer solution to this equation. !

There is one positive real solution $n = \frac{1}{2} + \frac{\sqrt{97}}{2}$.

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4. 22 elk, 6 tagged & released. Later, 5 captured.

What is P(2 of these are tagged)?

(4) Solution $\frac{\binom{6}{2}\binom{16}{3}}{\binom{22}{5}} = .31848$