Problem Sets due Jun 1, 2022 17:13 +03

Video

is bigger than or equal to the probability of its subset,

but as we saw, sometimes we don't quite grasp it that way,

okay, and what are we going to do next time?

We'll discuss conditional probability.

See you then.

18:07 / 18:07 1.0x

End of transcript. Skip to the start.

5.7_Probability_Inequalities

POLL

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations. Which is more probable?

RESULTS

Linda is a bank teller	**74%**
Linda is a bank teller and is active in the feminist movement	**26%**

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Results gathered from 39 respondents.

FEEDBACK

It is more probable that Linda is a bank teller than Linda is both a bank teller and an activist.

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1 (Graded)

2/2 points (graded)

Which of the following holds for all events A and B

a. in any probability space:

- [x] $A \supseteq B \quad \longrightarrow \quad P(A) \geq P(B)$
- [ ] $P(A) \geq P(B) \quad \longrightarrow \quad A \supseteq B$
- [ ] $|A| \geq |B| \quad \longrightarrow \quad P(A) \geq P(B)$
- [ ] $P(A) \geq P(B) \quad \longrightarrow \quad |A| \geq |B|$

✔

Explanation

1. $A \supseteq B \quad \longrightarrow \quad P(A) = P(B) + P(A \setminus B) \geq P(B)$.
2. A and B can be nonempty and disjoint with $P(A) \geq P(B)$, then A does not contain B.
3. B can be a singleton with higher probability than a set A with two elements.
4. Similar counter-example to 3.

b. in any **uniform** probability space:

- [x] $A \supseteq B \quad \longrightarrow \quad P(A) \geq P(B)$

- [ ] $P(A) \geq P(B) \quad \longrightarrow \quad A \supseteq B$
- [x] $|A| \geq |B| \quad \longrightarrow \quad P(A) \geq P(B)$
- [x] $P(A) \geq P(B) \quad \longrightarrow \quad |A| \geq |B|$

✔

Explanation

1. Follows from the result for general spaces.
2. Similar counter-example to part a.
3. I uniform sample spaces S, for any event E, $P(E) = |E|/|S|$, hence $|A| \geq |B| \quad \longrightarrow \quad P(A) \geq P(B)$.
4. Again, follows since for any event E, $P(E) = |E|/|S|$.

Submit You have used 2 of 4 attempts

Answers are displayed within the problem

2 (Graded)

2/2 points (graded)

Let Ω be any sample space, and A, B are subsets of Ω. Which of the following statements are always true?

- [ ] If $|A| + |B| \geq |\Omega|$, then $P(A \cup B) = 1$
- [ ] If $|A| + |B| \geq |\Omega|$, then $P(A) + P(B) \geq 1$
- [x] If $P(A) + P(B) > 1$, then $A \cap B \neq \emptyset$
- [ ] If $P(A) + P(B) > 1$, then $P(A \cup B) = 1$

✔

Explanation
Let $\Omega = \{1, 2, 3\}$, and $P(1) = P(2) = 0.1, P(3) = 0.8$.
- False. Let $A = B = \{1, 2\}$. $|A| + |B| = 4 > |\Omega|$, but $P(A \cup B) = 0.2$.
- False. Let $A = B = \{1, 2\}$. $|A| + |B| = 4 > |\Omega|$, but $P(A) + P(B) = 0.4$.
- True.
- False. Let $A = B = \{3\}$. $P(A) + P(B) = 1.6 > 1$, but $P(A \cup B) = 0.8$.

Submit You have used 2 of 4 attempts

Answers are displayed within the problem

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