Lec 8/29

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axioms: 1) $P(A) \geq 0 \quad \forall A \subseteq S$

2) $P(S) = 1$

don't need to show this holds? → 3) If $A_1, A_2, \ldots A_n$ are mutually excl. (n could be ∞)

$$P(A_1 \cup A_2 \cup, \ldots) = P(A_1) + P(A_2) + \ldots$$

① if A is any event in S

then $A = \underset{\text{outcomes (singletons)}}{O_1 \cup O_2} \cup \ldots$ (finite or infinite)

so $P(A) = P(O_1 \cup O_2 \cup \ldots)$ and since $O_1, O_2, \ldots$ are ME,

$P(A) = P(O_1) + P(O_2) + \ldots$

Ex 3 consecutive fair coin flips

$P(A)$ where A is the event of getting ≥ 2 tails $= \frac{1}{2}$ by binomial dist.

$S = \{HHH, HHT, \ldots, TTT\}$ each outcome has equal prob, $\frac{1}{8}$

$A = \{HTT, THT, TTH, TTT\}$

so $P(A) = 4 \cdot \frac{1}{8} = \frac{1}{2}$

Ex Suppose $O_1, O_2, O_3, \ldots$ is an ∞ sequence of outcomes

s $P(O_i) = (\frac{1}{2})^i$. is this a valid probability dist/measure? Yes.

☆ $\sum_{i=1}^{\infty} = \frac{1}{1-\frac{1}{2}} - 1 = 1$ (→ or $\frac{1}{2}(\frac{1}{1-\frac{1}{2}})$) so $P(S) = 1 = P(O_1 \cup O_2 \cup \ldots)$

$P(O_i) \geq 0$

If an experiment has $\underset{}{N}$ ($\to |S| = N$) possible equally likely outcomes, and $|A| = n$ then $P(A) = \frac{n}{N}$

Ex 5 card stud poker

$$P(\text{two pair}) = \frac{\binom{13}{1}\binom{4}{2}\binom{12}{1}\binom{4}{2}\binom{44}{1}}{\binom{52}{6}} = \frac{247,104}{2,598,960} = 0.0951$$

$\binom{44}{1} \to \binom{11}{1}\binom{4}{1}$; numerator $\leftarrow n$; $\binom{52}{6} \longrightarrow N$

2.5 Prob rules

1) $P(A \cup A') = P(S) = 1$

$\Rightarrow P(A \cup A') = \underbrace{P(A) + P(A') = 1}_{P(A) = 1 - P(A')} \longrightarrow$ complement rule

2) $P(\emptyset) = 0$

3) if $A \subseteq B$ then $P(A) \leq P(B)$

4) $0 \leq P(A) \leq 1$

5) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ "General Addition Rule"