

Probability Problem: Tossing Three Unbiased Coins

Data Science and A.I. Lecture Series

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Problem Statement

Three unbiased coins are tossed simultaneously. Find the probability of:

- 1 At least two heads
- 2 At most two heads
- 3 All heads
- 4 Exactly one head
- 5 Exactly one tail

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Sample Space:

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Sample Space: The sample space S for tossing three unbiased coins is:

$$S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$$

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Sample Space: The sample space S for tossing three unbiased coins is:

$$S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$$

The total number of outcomes is:

$$|S| = 8$$

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At least two heads:

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At least two heads: Outcomes with two or more heads are:

$$\{HHH, HHT, HTH, THH\}$$

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At least two heads: Outcomes with two or more heads are:

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The number of favorable outcomes is:

4

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At least two heads: Outcomes with two or more heads are:

$$\{HHH, HHT, HTH, THH\}$$

The number of favorable outcomes is:

4

The probability is:

$$P(\text{At least two heads}) = \frac{\text{Favorable outcomes}}{\text{Total outcomes}} = \frac{4}{8} = \frac{1}{2}$$

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At most two heads:

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At most two heads: Outcomes with zero, one, or two heads are:

$$\{HTT, THT, TTH, TTT, HHT, HTH, THH\}$$

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At most two heads: Outcomes with zero, one, or two heads are:

$$\{HTT, THT, TTH, TTT, HHT, HTH, THH\}$$

The number of favorable outcomes is:

7

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- 3 All heads
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- 5 Exactly one tail

At most two heads: Outcomes with zero, one, or two heads are:

$$\{HTT, THT, TTH, TTT, HHT, HTH, THH\}$$

The number of favorable outcomes is:

7

The probability is:

$$P(\text{At most two heads}) = \frac{\text{Favorable outcomes}}{\text{Total outcomes}} = \frac{7}{8}$$

Problem Statement (Always Visible)

Problem: Three unbiased coins are tossed simultaneously.

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- 1 At least two heads
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All heads:

Problem Statement (Always Visible)

Problem: Three unbiased coins are tossed simultaneously.

Find the probability of:

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All heads: The only outcome with all heads is:

$$\{HHH\}$$

Problem Statement (Always Visible)

Problem: Three unbiased coins are tossed simultaneously.

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All heads: The only outcome with all heads is:

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The number of favorable outcomes is:

$$1$$

Problem Statement (Always Visible)

Problem: Three unbiased coins are tossed simultaneously.

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All heads: The only outcome with all heads is:

$$\{HHH\}$$

The number of favorable outcomes is:

$$1$$

The probability is:

$$P(\text{All heads}) = \frac{\text{Favorable outcomes}}{\text{Total outcomes}} = \frac{1}{8}$$

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Exactly one head:

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Exactly one head: Outcomes with exactly one head are:

$$\{HTT, THT, TTH\}$$

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Exactly one head: Outcomes with exactly one head are:

$$\{HTT, THT, TTH\}$$

The number of favorable outcomes is:

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Exactly one head: Outcomes with exactly one head are:

$$\{HTT, THT, TTH\}$$

The number of favorable outcomes is:

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The probability is:

$$P(\text{Exactly one head}) = \frac{\text{Favorable outcomes}}{\text{Total outcomes}} = \frac{3}{8}$$

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Exactly one tail:

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Exactly one tail: Outcomes with exactly one tail are:

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Exactly one tail: Outcomes with exactly one tail are:

$$\{HHT, HTH, THH\}$$

The number of favorable outcomes is:

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- 1 At least two heads
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- 3 All heads
- 4 Exactly one head
- 5 Exactly one tail

Exactly one tail: Outcomes with exactly one tail are:

$$\{HHT, HTH, THH\}$$

The number of favorable outcomes is:

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The probability is:

$$P(\text{Exactly one tail}) = \frac{\text{Favorable outcomes}}{\text{Total outcomes}} = \frac{3}{8}$$

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Results:

- Probability of at least two heads: $\frac{1}{2}$

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Results:

- Probability of at least two heads: $\frac{1}{2}$
- Probability of at most two heads: $\frac{7}{8}$

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Results:

- Probability of at least two heads: $\frac{1}{2}$
- Probability of at most two heads: $\frac{7}{8}$
- Probability of all heads: $\frac{1}{8}$

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Results:

- Probability of at least two heads: $\frac{1}{2}$
- Probability of at most two heads: $\frac{7}{8}$
- Probability of all heads: $\frac{1}{8}$
- Probability of exactly one head: $\frac{3}{8}$

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Results:

- Probability of at least two heads: $\frac{1}{2}$
- Probability of at most two heads: $\frac{7}{8}$
- Probability of all heads: $\frac{1}{8}$
- Probability of exactly one head: $\frac{3}{8}$
- Probability of exactly one tail: $\frac{3}{8}$

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