Huynh Le An Khanh
Vietnamese-German University
Binh Duong, Vietnam

September 18, 2025

Tutorial 1 - Mathematics for CS

1. (a) What is the sample space when a coin is tossed 3 times?

$$\mathcal{S} = \{(x, y, z)|x, y, z \in \{\text{head}, \text{tail}\}\}$$

   (b) What is the sample space for counting the number of females in a group of n people?

$$\mathcal{S} = \{x|0 \leq x \leq n\}$$

   (c) What is the sample space for the number of aces in a hand of 13 playing cards?

$$\mathcal{S} = \{x|0 \leq x \leq 4\}$$

   (d) What is the sample space for a person's birthday?

$$\begin{aligned} \mathcal{S} = \{&\text{Jan 1st}, && \ldots, && \text{Jan 31st} \\ &\text{Feb 1st}, && \ldots, && \text{Feb 29th} \\ &\text{Mar 1st}, && \ldots, && \text{Mar 31st} \\ &\vdots && \vdots && \vdots \\ &\text{Dec 1st}, && \ldots, && \text{Dec 31st}\} \end{aligned}$$

   (e) A car repair is performed either on time or late and either satisfactorily or unsatisfactorily. What is the sample space for a car repair?

$$\mathcal{S} = \{(x, y)|x \in \{\text{on time,late}\}, y \in \{\text{satisfactorily,unsatisfactorily}\}\}$$

   (f) A bag contains balls that are either red or blue and either dull or shiny. What is the sample space when a ball is chosen from the bag?

$$\mathcal{S} = \{(x, y)|x \in \{\text{red,blue}\}, y \in \{\text{dull,shiny}\}\}$$

2. A probability value p is often reported as an odds ratio, which is $\frac{p}{1-p}$. This is the ratio of the probability that the event happens to the probability that an event does not happen.

   (a) If the odds ratio is 1, what is p?

$$\frac{p}{1-p} = 1 \Leftrightarrow p = 1 - p \Leftrightarrow p = 0.5$$

   (b) If the odds ratio is 2, what is p?

$$\frac{p}{1-p} = 2 \Leftrightarrow p = 2 - 2p \Leftrightarrow p = 2/3$$

(c) If p = 0.25, what is the odds ratio?

$$\frac{p}{1-p} = \frac{0.25}{1-0.25} = 1/3$$

(d) What are the possible values for the odds ratio?
Since as $p \to 1^-$:

$$\lim_{p \to 1^-} \frac{p}{1-p} = +\infty$$

and with $p = 0$: $\dfrac{p}{1-p} = 0$
and $\frac{p}{1-p}$ is continuous on $(0, 1)$
Hence $\frac{p}{1-p}$ takes all value in $[0, \infty]$

3. (a) An experiment has 5 outcomes: I, II, III, IV and V. If $P(\text{I}) = 0.13$,$P(\text{II}) = 0.24$,$P(\text{III}) = 0.07$ and $P(\text{IV}) = 0.38$, what is $P(\text{V})$?

$$P(\text{V}) = 1 - P(\text{I}) - P(\text{II}) - P(\text{III}) - P(\text{IV}) = 1 - 0.13 - 0.24 - 0.07 - 0.38 = 0.18$$

(b) An experiment has 5 outcomes: I, II, III, IV and V. If $P(\text{I}) = 0.08$, $P(\text{II}) = 0.2$, $P(\text{III}) = 0.33$, what are the possible values for the probability of outcome V? If outcomes IV and V are equally likely, what are their probabilities values?

$$2P(\text{V}) = P(\text{V}) + P(\text{IV}) = 1 - P(\text{III}) - P(\text{II}) - P(\text{I}) = 1 - 0.08 - 0.2 - 0.33 = 0.39 \Rightarrow P(\text{V}) = 0.195$$

4. An experiment has 3 outcomes: I, II and III. If outcome I is twice likely as outcome II and outcome II is 3 times as likely as outcome III, what are the probability values of the 3 outcomes?

$$\begin{cases} P(\text{I}) = 2P(\text{II}) \\ P(\text{II}) = 3P(\text{III}) \\ P(\text{I}) + P(\text{II}) + P(\text{III}) = 1 \end{cases} \Rightarrow \begin{cases} P(\text{I}) = 0.6 \\ P(\text{II}) = 0.3 \\ P(\text{III}) = 0.1 \end{cases}$$

5. A company's advertising expenditure is either low with probability 0.28, average with probability 0.55, or high with probability p. What is p?

$$p = 1 - P(\text{low}) - P(\text{average}) = 1 - 0.28 - 0.55 = 0.17$$

Submitted by Huynh Le An Khanh on September 18, 2025.