5.1 – Exploring Probability

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Probability: a measure of the likelihood of an event occurring.

Probability can be written as

i. A proper fraction
ii. A decimal

} between zero and one

- zero means the event is impossible (0%)
- one means the event is guaranteed (100%)

iii. A percent

between 0% and 100%

Experimental probability: the likelihood of an event occurring, found through repeated experimentation.

The **experimental probability** of an event, A, can be calculated using:

$$P(A) = \frac{n(A)}{n(T)}$$

Where n(A) = number of times event A occurred

n(T) = total number of trials

based on actual results

Theoretical probability: the likelihood of an event occurring, calculated using the possible outcomes in a sample space (all possible outcomes of an experiment).

The **theoretical probability** of an event, A, can be calculated using:

$$P(A) = \frac{n(A)}{n(S)}$$

Where n(A) = the number of favourable outcomes for event A

n(S) = number of outcomes in the sample space (number of different outcomes that could happen)

thinking about what could happen

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event A

Example: Find the probability of rolling a sum of 5 using two fair six-sided dice.

	1	2	3	4	5	6
1	1,1	1,2	1,3	1,4	1,5	1,6
2	2,1	2,2	2,3	2,4	2,5	2,6
3	3,1	3,2	3,3	3,4	3,5	3,6
4	4,1	4,2	4,3	4,4	4,5	4,6
5	5,1	5,2	5,3	5,4	5,5	5,6
6	6,1	6,2	6,3	6,4	6,5	6,6

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(\text{sum of } 5) = \frac{4}{36}$$

4 ← number of fav. outcomes (sum = 5)

36 ← total number of possible outcomes

$$= \frac{1}{9} \text{ OR } 0.11 \text{ or } 11.1\%$$

Example: Sam is ordering a pizza. He has three types of cheese to choose from (mozzarella, cheddar and feta), four types of meat (bacon, ground beef, chicken, and sardines), and two types of crust (regular and stuffed).

a. How many different pizzas can be made with one type of cheese and one type of meat?

$3 \times 4 \times 2 = 24$ different pizzas

(3 cheese, 4 meat, 2 crust)

$n(S) = 24$ ← total number of outcomes in sample space.

b. If Sam chooses at random, what is the probability that his pizza includes feta?

how many one cheese/one meat combos include feta?

$1 \times 4 \times 2 = 8$ (1 feta, 4 meat, 2 crust) of the possibilities include feta $n(F)$

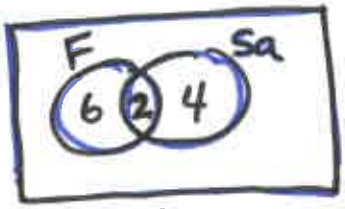
$$P(F) = \frac{n(F)}{n(S)} = \frac{8}{24} = \frac{1}{3} \text{ or } 0.33 \text{ or } 33.3\%$$

c. If Sam chooses at random, what is the probability that his pizza includes feta or sardines?

$n(F) = 8$

$n(Sa) = 3 \times 1 \times 2 = 6$ (1 sardines)

$n(F \cap Sa) = 1 \times 1 \times 2 = 2$ (1 feta, 1 sardines)



$n(F \cup Sa) = 6 + 2 + 4 = 12$

or $n(F \cup Sa) = 8 + 6 - 2 = 12$

$$P(F \cup Sa) = \frac{n(F \cup Sa)}{n(S)} = \frac{12}{24} = \frac{1}{2} \text{ or } 0.5 \text{ or } 50\%$$