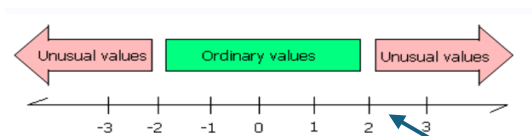


Section 4: Z- Score / Basic probability / Multiplication Rule

1. Z – Score: Measures as how **many standard deviations** a data is away from the mean.

Formula $Z = \frac{x - \bar{x}}{s}$ and explain if it is **ordinary** or **unusual**



Is someone's blood pressure of 175 considered normal or unusual, if average blood pressure is 130 with standard deviation of 20. Let's calculate **Z**, $Z = (175-130)/20=2.25$ It is considered unusually high

2. What is probability

Probability measures how likely an event is to occur and is quantified between 0 and 1, where 0 indicates impossibility and 1 signifies certainty. Mathematically, the probability of an event A, denoted as P(A), can be expressed in three forms: as a fraction, a decimal, or a percentage.

3. Four steps in finding the probability

- Experiment: What is done? Flipping a **coin**, rolling a **die**, drawing a **card**
- Sample space: Total number of outcomes for that experiment = **n** **n = 2** or **6** or **52**
- Event**: outcome or outcomes we like to happen (getting **Tail, 5, Ace**) = **f** **f = 1** or **1** or **4**
- Probability that **event** occurs = $P(E)=f/n$ = Probability of getting (Tail, 5, Ace)
1/2 1/6, 4/52

4. Three types of probabilities (**Classical / Empirical / Subjective**)

Classical: the outcome for each outcome is known and always constant

Probability of the coin landing **H** is $\frac{1}{2}$ or Probability of getting 3 when you roll a die is $\frac{1}{6}$ or $P(3) = \frac{1}{6}$

Empirical: Requires data

In a box there are 12 red and 8 blue marbles, the probability of picking red is $\frac{12}{20}$ or 60%

Subjective: the likelihood of an event occurring based on an individual's personal judgment or experience. Example: a doctor may say the chance of recovery is 90%

- Law of large numbers: stating that as the number of trials in an experiment increases, the average of the results will converge to the expected value
- Multiplication Rule (**keywords**: and / both / all) its formula

$$P(A \text{ and } B \text{ and } C \text{ and } \dots) = P(A)P(B)P(C)\dots$$

Means probability events A, B and C and ... happens

7. Difference in using multiplication rule when we make selection **with** or **without replacement**