A. Definitions:

1. An experiment is any activity or procedure that produces distinct, well-defined possibilities called outcomes which can be observed or measured, but which cannot be predicted with certainty.

2. Each outcome is an element in the universal set of all possible outcomes for the experiment.

3. The universal set is called the sample space.

   (a) Example: A fair coin is tossed twice and the result of each toss is recorded. Find the sample space of the result. \( S = \{HH, HT, TH, TT\} \)

B. Assignment of Probabilities

1. Suppose the sample space of an experiment has \( n \) outcomes given by \( S = \{e_1, e_2, e_3, \ldots, e_n\} \).
   To each outcome we assign a real number \( P(e) \) which is called the probability of the outcome \( e \). Then:

   \[ P(e_1) \geq 0, P(e_2) \geq 0, \ldots, P(e_n) \geq 0 \text{ and } P(e_1) + P(e_2) + \ldots + P(e_n) = 1 \]

2. Example: A die is rolled. Find the sample space and assign probabilities:
   \( S = \{1, 2, 3, 4, 5, 6\} \), \( P(1) = \frac{1}{6} \), \( P(2) = \frac{1}{6} \), \( P(3) = \frac{1}{6} \), \( P(4) = \frac{1}{6} \), \( P(5) = \frac{1}{6} \), \( P(6) = \frac{1}{6} \)

3. Note: When the same probability is assigned to each outcome of a sample space, the outcomes are said to be equally likely.

C. Formula:

1. \( P(E) = \frac{\text{(number of ways } E \text{ can take place)}}{\text{(number of outcomes)}} = \frac{n(E)}{n(S)} \)

2. Example: A bowl contains 4 red marbles, 7 green ones, 6 blue ones and 5 white marbles. If Jay chooses one marble, find the probability that:
   (a) it is green: \( \frac{7}{22} \)
   (b) it is red: \( \frac{4}{22} = \frac{2}{11} \)
   (c) it is red or blue: \( \frac{4+6}{22} = \frac{10}{22} = \frac{5}{11} \) or \( \frac{4}{22} + \frac{6}{22} = \frac{10}{22} = \frac{5}{11} \)