Ma 301

unit 1

تجربة Experiment : هي موضوع يراد دراسته — rolling a die رمي زهر، tossing a coin رمي عملة، draw a ball سحب كرة

Sample space: كل النتائج الممكنة

حدث event : يحدث يطلب دراسة احتمالها

outcome : جميع نتائج event

probability: $\frac{\text{عدد نتائج outcome}}{\text{عدد نتائج space}}$

Experiments بعض التجارب

① rolling a fair die — جميع النتائج لها نفس الاحتمال

Sample space = {1, 2, 3, 4, 5, 6}

② rolling a biased die

Sample space = {1, 2, 3, 4, 5, 6}

③ tossing a fair Coin

Sample space = {head, tail}

④ tossing a biased Coin

Sample space = {head, tail}

⑤ draw a Card from a playing Cards



1
2
3
4
5
6
7
8
9
10
J
Q
K

Sample space
$13 \times 4 = 52$

Example

An engineer in charge of the maintenance of a particular machine notices that its breakdowns can be characterized as due to one of three reasons:

1. an electrical failure within the machine,
2. a mechanical failure of some component of the machine,
3. operator misuse.

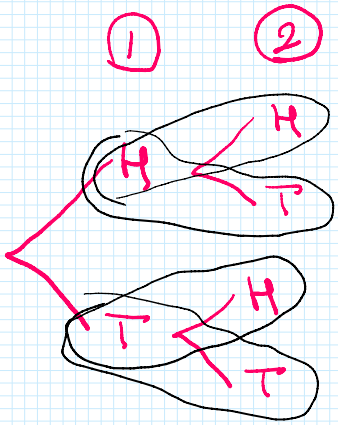
When the machine is running, the engineer is uncertain what will be the cause of the next breakdown.

The problem can be thought of as an experiment with the sample space

S = {electrical, mechanical, misuse}

experiment تكرار التجربة

tossing 2 coins (tossing a coin twice)



Sample space

H, H

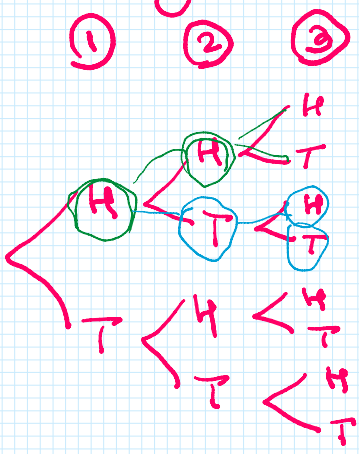
H, T

T, H

T, T

Sample Space = {HH, HT, TH, TT}

tossing 3 coins



Sample space

HHH
HHT
HTH
HTT
THH
THT
TTH
TTT

Sample Space = {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}

rolling 2 dice (rolling a die twice)

	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

→ Sample space

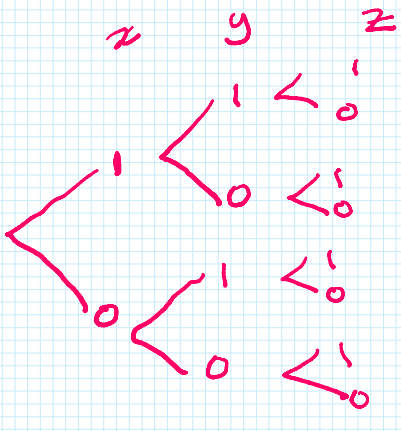
Example

A manager supervises the operation of three power plants, plant X, plant Y, and plant Z.

At any given time, each of the three plants can be classified as either generating electricity (1) or being idle (0).

With the notation (0, 1, 0) used to represent the situation where plant Y is generating electricity but plants X and Z are both idle.
The sample space for the status of the three plants at a particular point in time is

S = {(0, 0, 0), (0, 0, 1), (0, 1, 0), (0, 1, 1), (1, 0, 0), (1, 0, 1), (1, 1, 0), (1, 1, 1)}



Sample space

1,1,1
1,1,0
1,0,1
1,0,0
0,1,1
0,1,0
0,0,1
0,0,0

$0 \leq$ probability ≤ 1

impossible

Certain

* مجموع احتمالات تجربة = 1

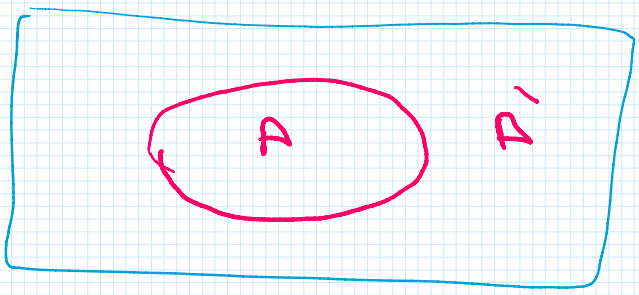
$$\sum_{x=1} P_x = 1$$

Complement : متممة

Venn diagram:

Sample Space

Venns diagram:



Complement : عدم حدوث

$P(A)$: احتمال حدوث

$P(A')$ = احتمال عدم حدوث

$$P(A') = 1 - P(A)$$

* rolling a dic

A: even number

find $P(A)$

Sample space = {1, 2, 3, 4, 5, 6} 3

outcomes (A) = {2, 4, 6} 6

$$P = \frac{3}{6}$$

Probability of (not) getting an even number

$$P(A) = \frac{3}{6}$$

$$P(A') = 1 - \frac{3}{6} = \frac{3}{6}$$

$$P(A') = 1 - \frac{3}{6} = \frac{3}{6}$$

