Probability

Ms. Ashiyana M. Makandar
Assistant Professor
Department of Statistics
Vivekanand College, Kolhapur

- Two ways to calculate model:
- Classical model:
  - Number of outcomes in which the event occurs/ Total number of possible outcomes of an experiment

- Relative Frequency
  - Number of times an event occurred/ Total number of opportunities for an event to occur

Some terminologies

- Experiment/ Trial: some thing is done with expectation of the result
- Event /Outcome: Result of experiment
- Sample space: sample space of an experiment is the set of all possible result of that random experiment
- E.g. For an dice sample space is
  - {1,2,3,4,5,6}

- For two dice sample space is:
- {(1,1),(1,2),(1,3),(1,4),(1,5),(1,6),

(2,1),(2,2),(2,3),(2,4),(2,5),(2,6),

(3,1),(3,2),(3,3),(3,4),(3,5),(3,6),

(4,1),(4,2),(4,3),(4,4),(4,5),(4,6),

(5,1),(5,2),(5,3),(5,4),(5,5),(5,6),

(6,1),(6,2),(6,3),(6,4),(6,5),(6,6),}

Types of event

- Mutually exclusive event:
  - When two events can not occur at the same time
- Independent event:
  - occurrence of event A does not change the probability of event B.
- Complementary event :
  - The probability that event A will not occur is denoted by P(A').

Mutually exclusive event

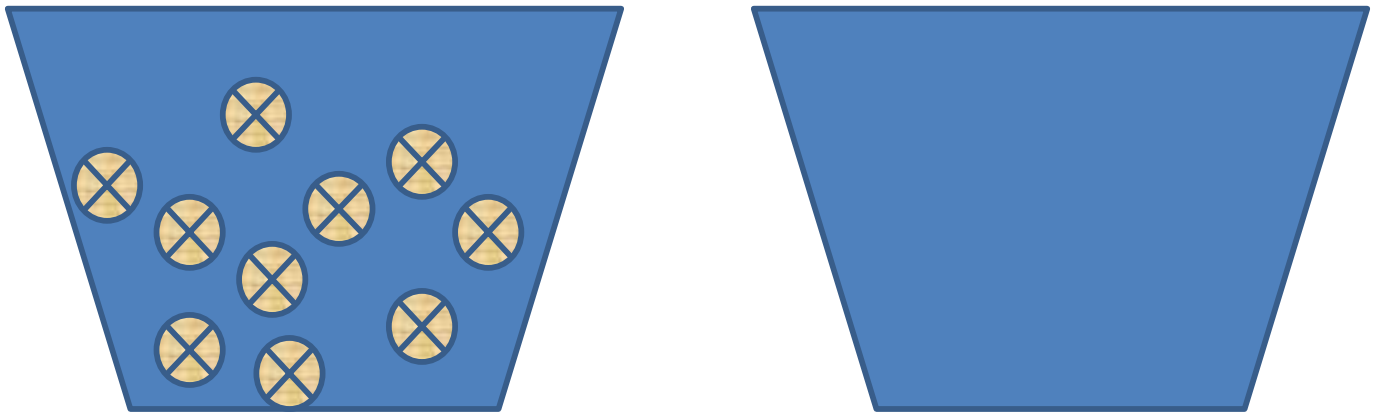
- Events which are no overlapping area in Venn diagram is the Mutually exclusive event.
- Event A and event B having totally different output and not having single common event.
- E.g. Event A is having outcome as {2,6}
- Event B is having outcome as {1,3,4,5}

Independent event

- Event B is not depend on event A
- E.g. After flipping the coin outcome is head, Which is not dependant on the previous event outcome.

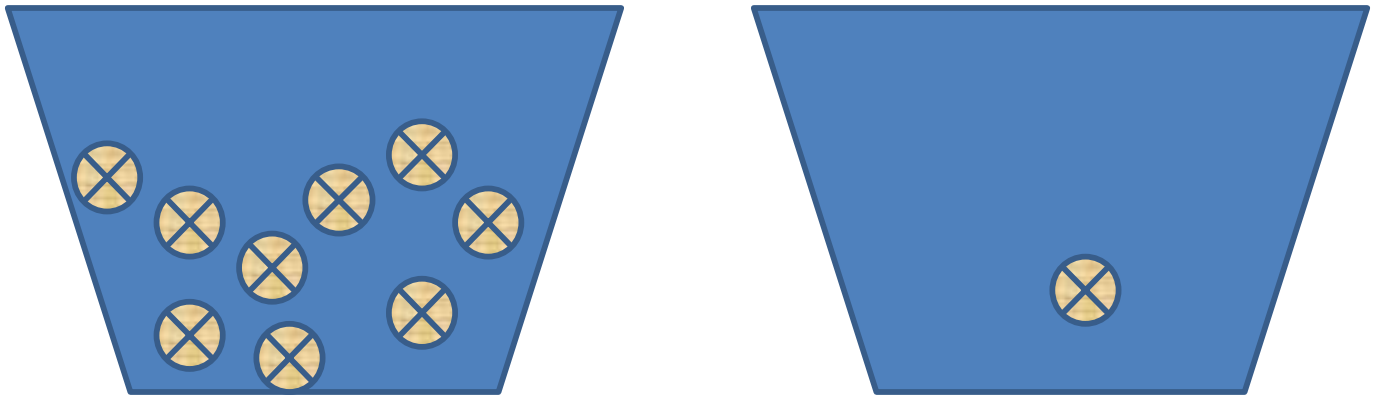
Dependent event

- Selection of ball from a basket.
- Suppose a basket is having 10 balls
- Event A: Probability of selecting one ball is 1/10



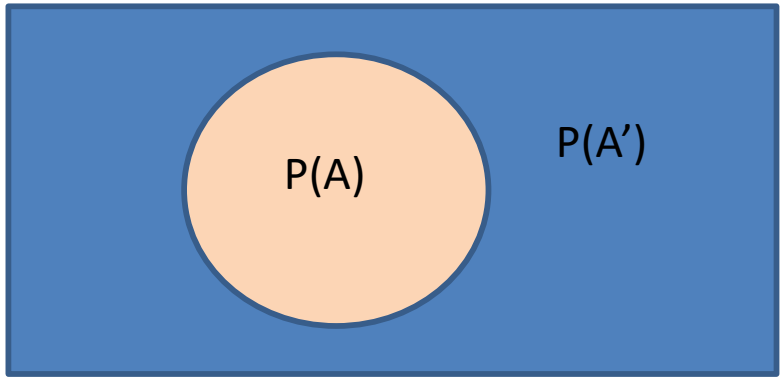
Dependant event B

- Now, keep the ball in other basket.
- Event B: Probability of selcting next ball is 1/9



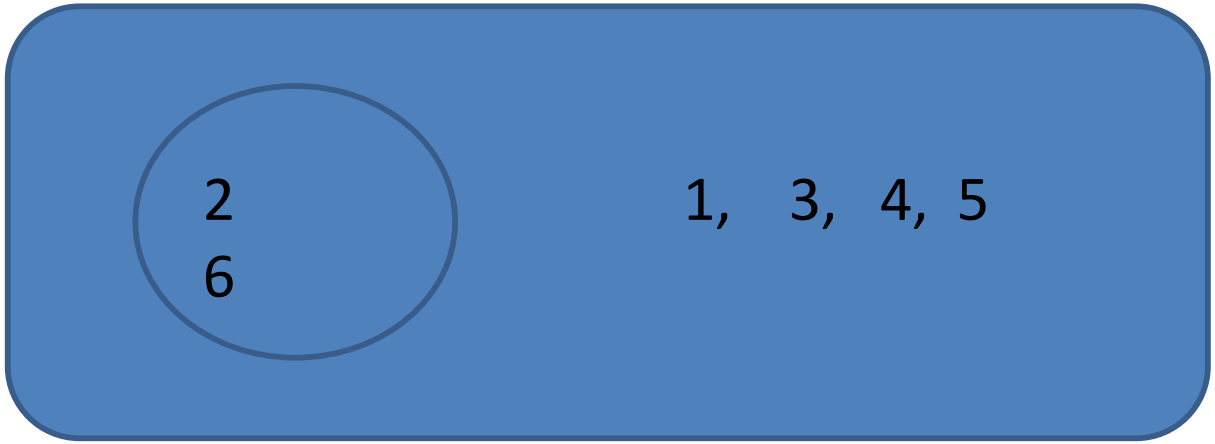
Complementary Event

- Event A
- Complementary event is exactly not happening in event A
- Complementary event is denoted by P(A’)



Venn diagram

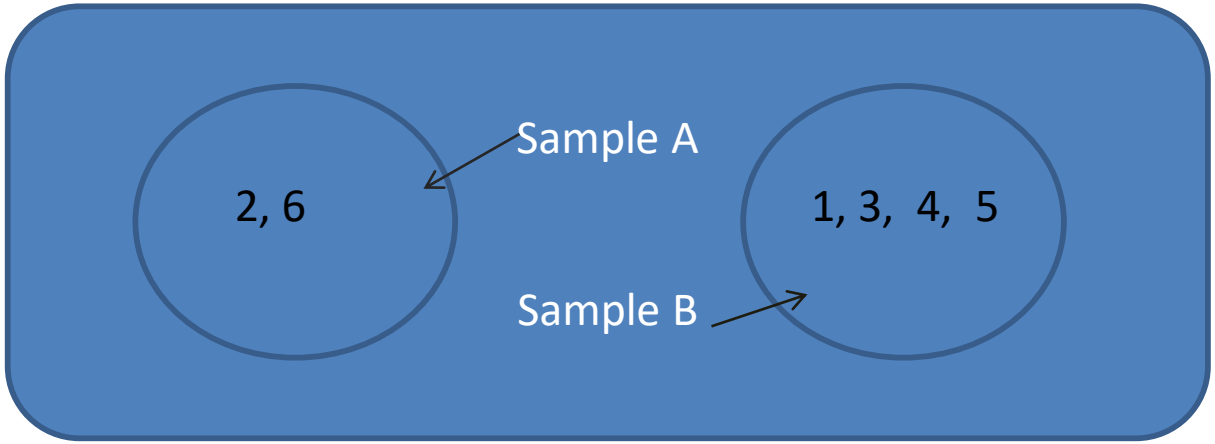
- Venn diagram graphically represents event and total sample space
- Event A: is rolling of a dice, output of the event might be 2 or 6 as a sample.



Event -B

- Event B: is rolling of a dice,

output of the event might be 1 ,3 , 4, 5



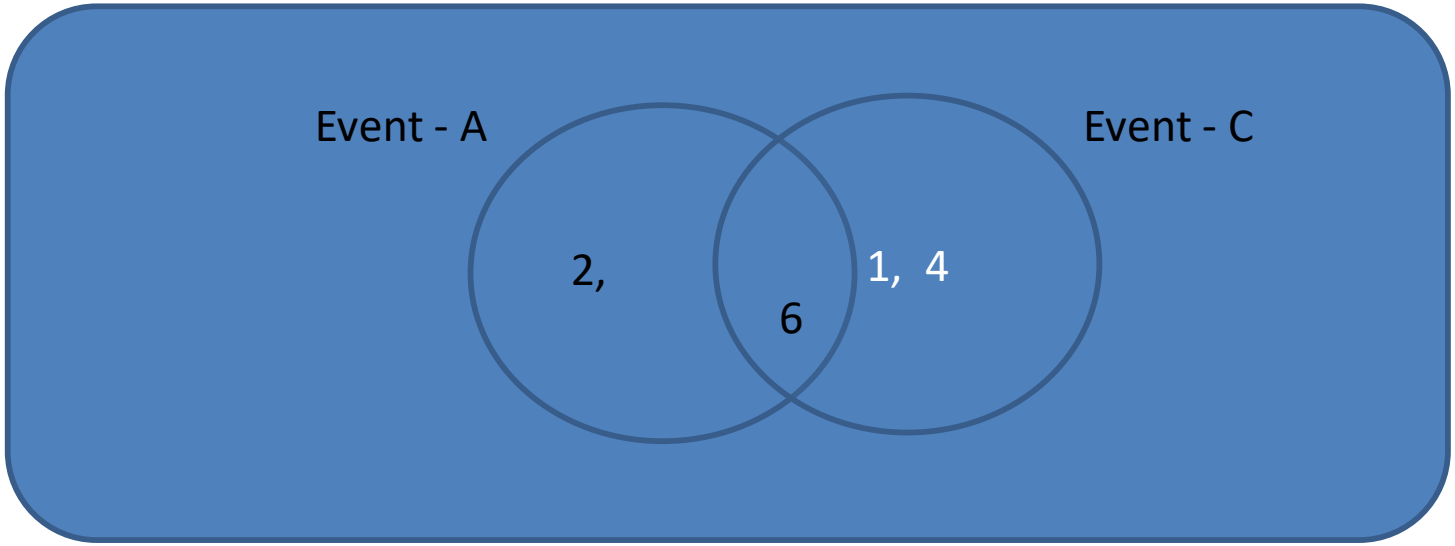
Observations

- If we observe event A and event B, there is no overlapping of samples.
- If two or more events are not overlapping, then these are mutually exclusive event.
- Mutually exclusive event cant occur at the same time.

Event - C

Event – C is getting probability of 2, 4 or 6
While event – A is having chances of getting 2 or 6

After rolling a dice 6 is the outcome. 6 is the part of event A and part of event B
Hence we can say A and C are not mutually exclusive



Set Operations

- Union:
- Probability of occurrence of either event A or event B is P(A ∪ B)
- {1,2,3,4,5,6}

- Intersection
- Probability of occurrence of both event simultaneously i.e. Event A and event B
- P(A ∩ B)

Rules for more events

- Rule of addition (or condition)
- Rule of multiplication (and condition)
- Above both event will be used to work on multiple events.

Rule of Multiplication

- The probability that event A and B both occur = Probability that Event A occurs * Probability that event B occurs, given that A has occurred

- $P(A \cap B) = P(A)\, P(B|A)$
- E.g. Probability of getting head in both flipping two coins together.
- Event A is flipping both coins first time
- Event B is flipping both coins second time

Rule of multiplication(independent event)

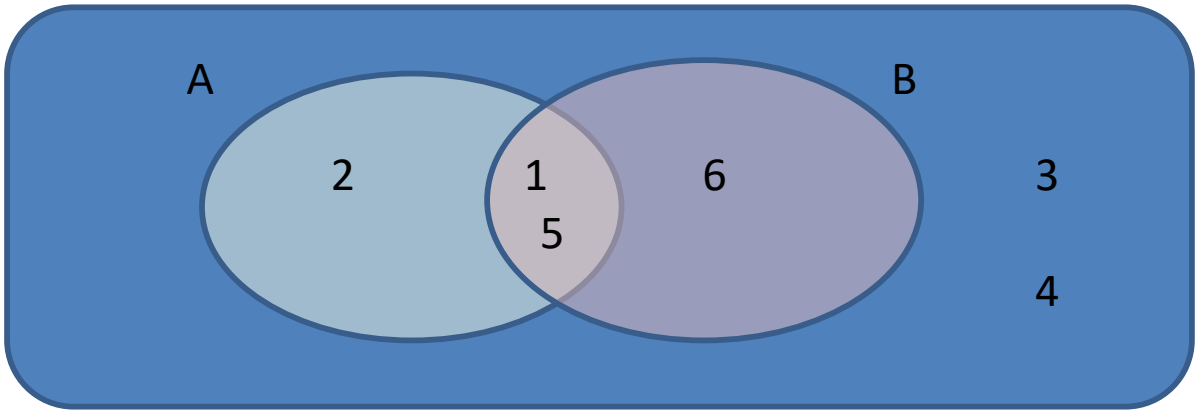
- Example : Two rolls dice what is the probability of getting 6 in both? (independent event)
- $P(A)=1/6$
- $P(B)=1/6$
- $P(B|A)$ is also 1/6 in case of independent event.
- $P(A \cap B) = 1/6 * 1/6 =1/36$
- Hence, probability of getting 6 when two dice roll together is 1/36

Rules of multiplication(dependent event)

- There are 10 balls in the basket, 5 green, 2 yellow, 2 orange, 1 red. If 2 random balls are selected what is the probability of getting both yellow balls?
- Getting yellow ball at first attempt $P(A) = 2/10$
- Probability of getting yellow when first yellow ball is already selected $P(B|A) = 1/9$
- $P(A \cap B) = 2/10 * 1/9 = 1/45$
- Hence probability of getting both yellow balls is 1/45

Rules of addition

- Probability that event A or event B occurs = Probability that event A occurs + Probability that event B occurs – Probability that both event A and B occur
- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$



Thank you