Statistics for Data Science -1

Lecture 6.3: Probability- Venn diagrams

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Learning objectives

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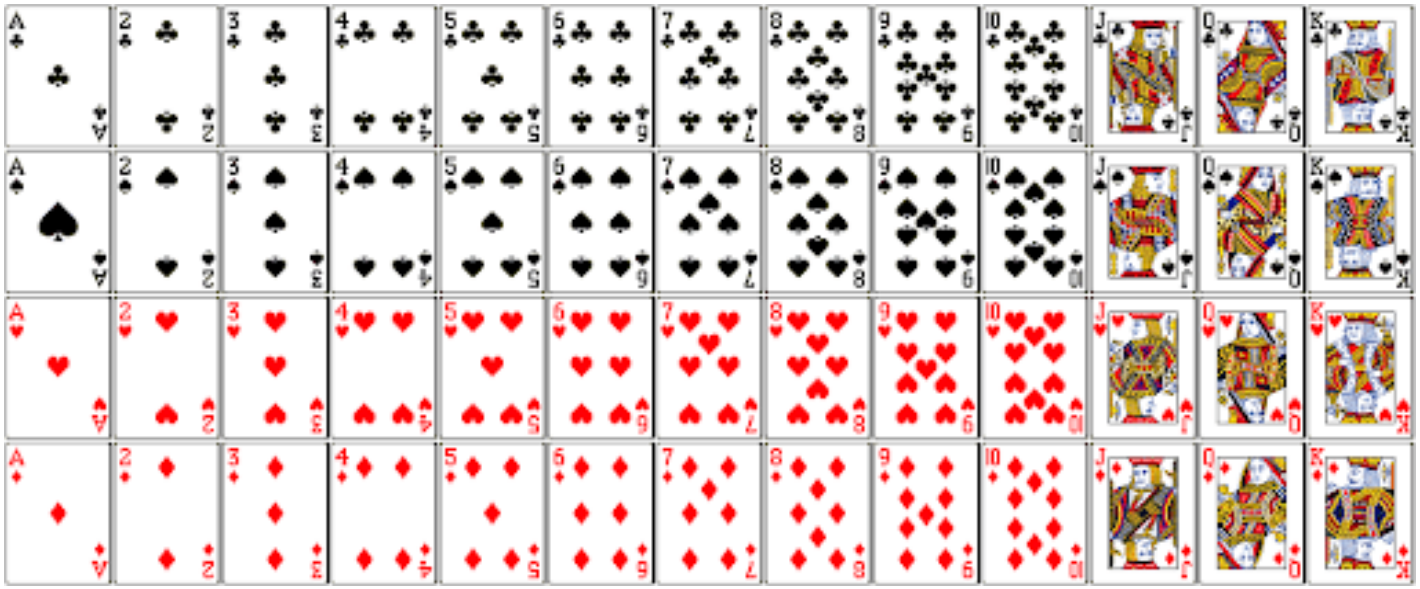
7. Distinguish between independent and dependent events.
8. Solve applications of probability.

Venn diagrams

Application: playing cards

- A deck of playing cards is a collection of 52 playing cards



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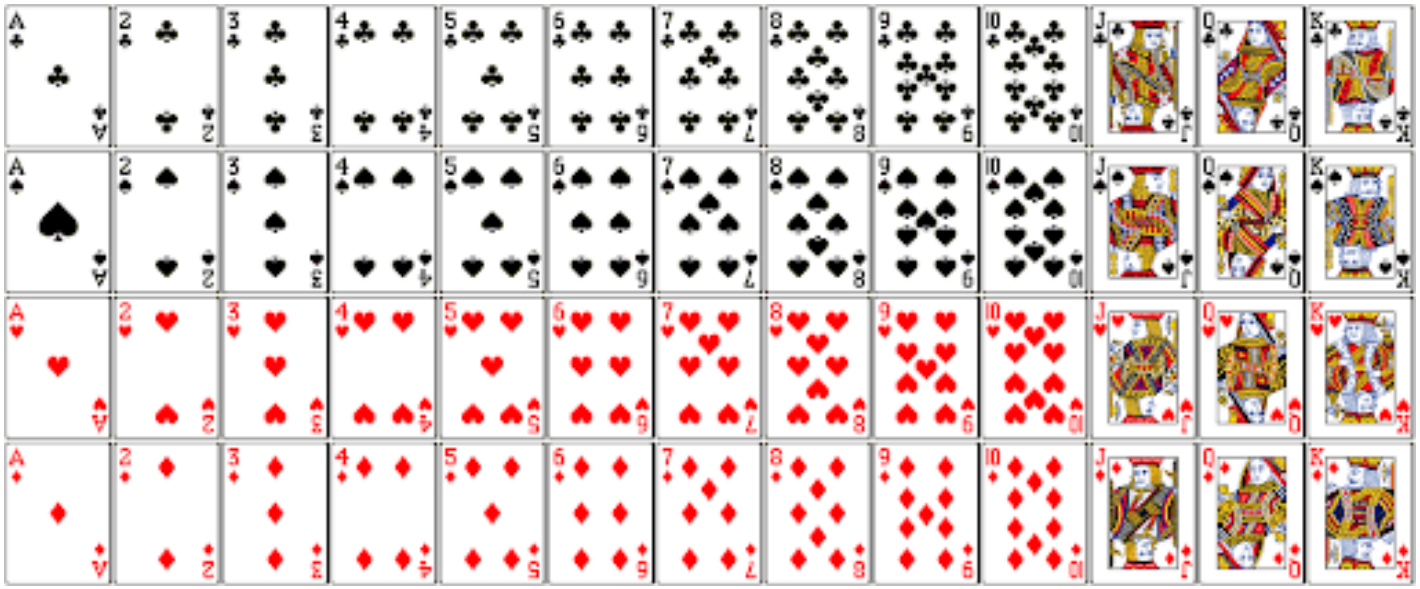

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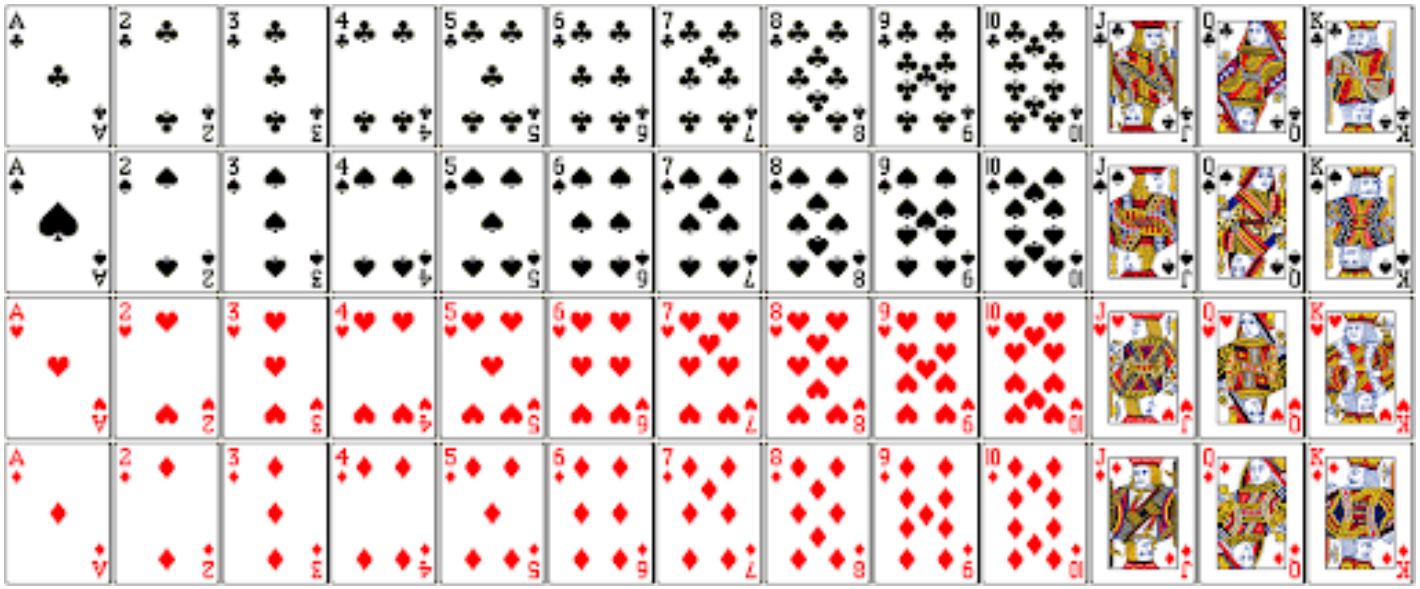


- Experiment: Randomly selecting one card from the deck, we will get one of these 52 cards
- Sample space: $S = \{\text{collection of all 52 cards}\}$

Application: playing cards contd.

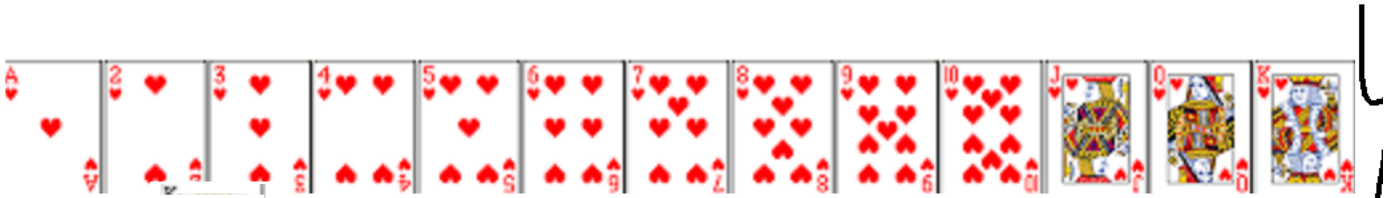
- Describe the event that the card selected is the king of hearts.

E= 

- Describe the event that the card selected is a king.

F= 

- Describe the event that the card selected is hearts.

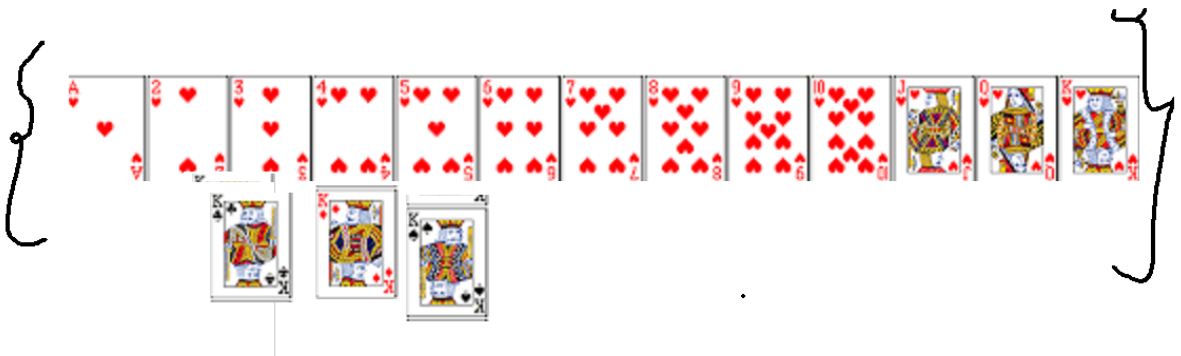
G= 

Application: playing cards contd.

- Determine and describe the event $F \cup G$

Application: playing cards contd.

- Determine and describe the event $F \cup G$
  Event $F \cup G$ implies the card selected is a King or a heart.
  Hence the outcome of $F \cup G$ is



Application: playing cards contd.

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- Determine and describe the event $F \cap G$
  Event $F \cap G$ implies the card selected is a King and a heart.
  Hence the outcome of $F \cap G$ is

  which is same as event E

Application: playing cards contd.

- Let H be the event of selecting an Ace. Are events G and H mutually exclusive?

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- Event G and event H are not mutually exclusive because they have the common outcome "ace of hearts." Both events occur if the card selected is the ace of hearts.

Application: playing cards contd.

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- Event G and event H are not mutually exclusive because they have the common outcome "ace of hearts." Both events occur if the card selected is the ace of hearts.
- Let I be the event of selecting a Queen. Are events F and I mutually exclusive?

Application: playing cards contd.

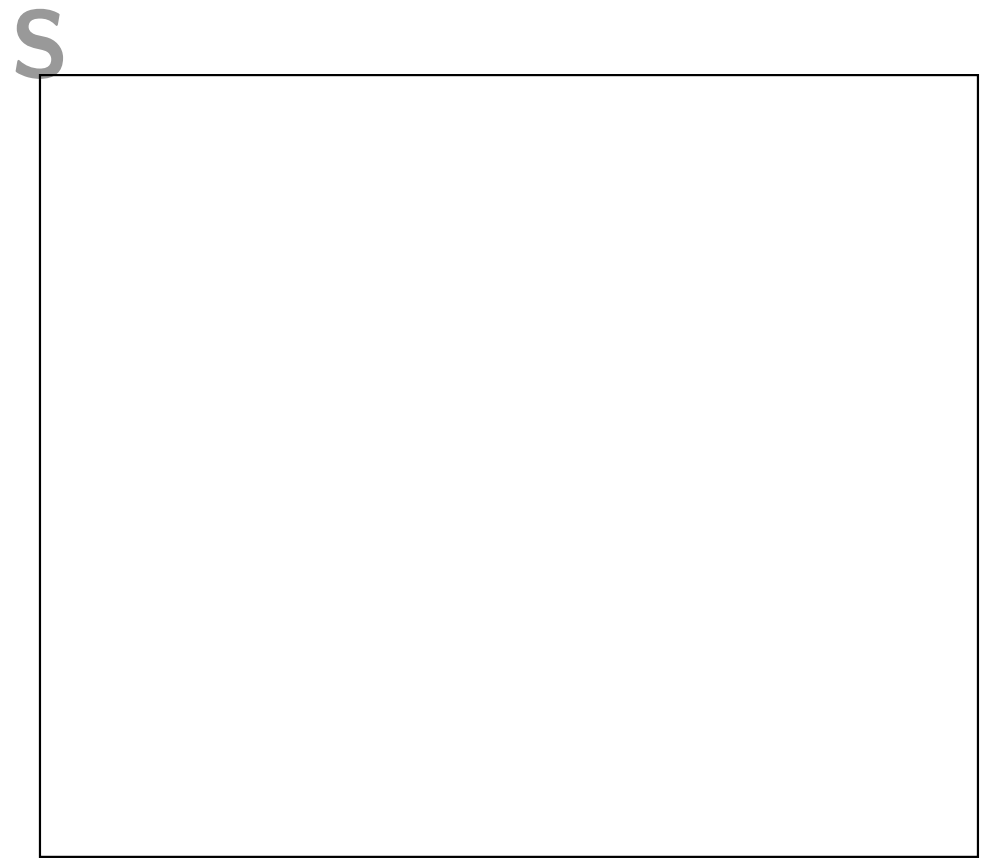
- Let H be the event of selecting an Ace. Are events G and H mutually exclusive?
- Event G and event H are not mutually exclusive because they have the common outcome "ace of hearts." Both events occur if the card selected is the ace of hearts.
- Let I be the event of selecting a Queen. Are events F and I mutually exclusive? Yes. If we select a king card, we cannot select a queen card.

Venn diagrams

- A graphical representation that is useful for illustrating logical relations among events is the Venn diagram.

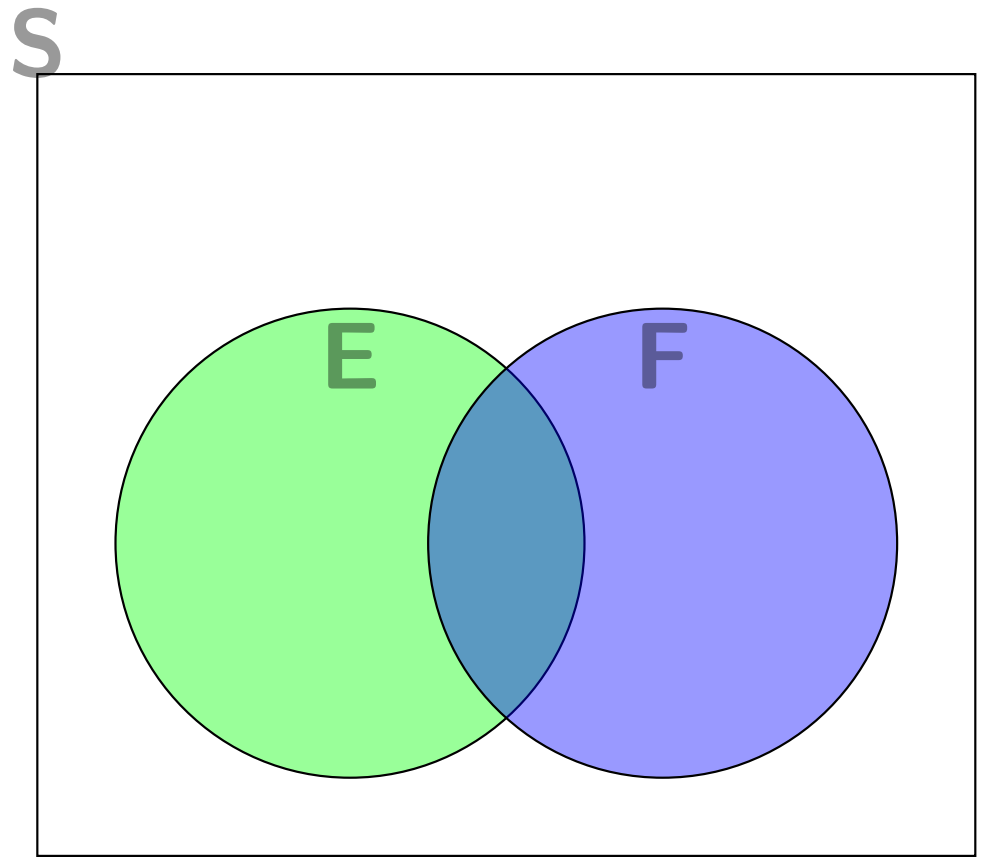
Representation of sample space

- Representation of sample space: Sample space consists of all possible outcomes and is represented by a large rectangle.



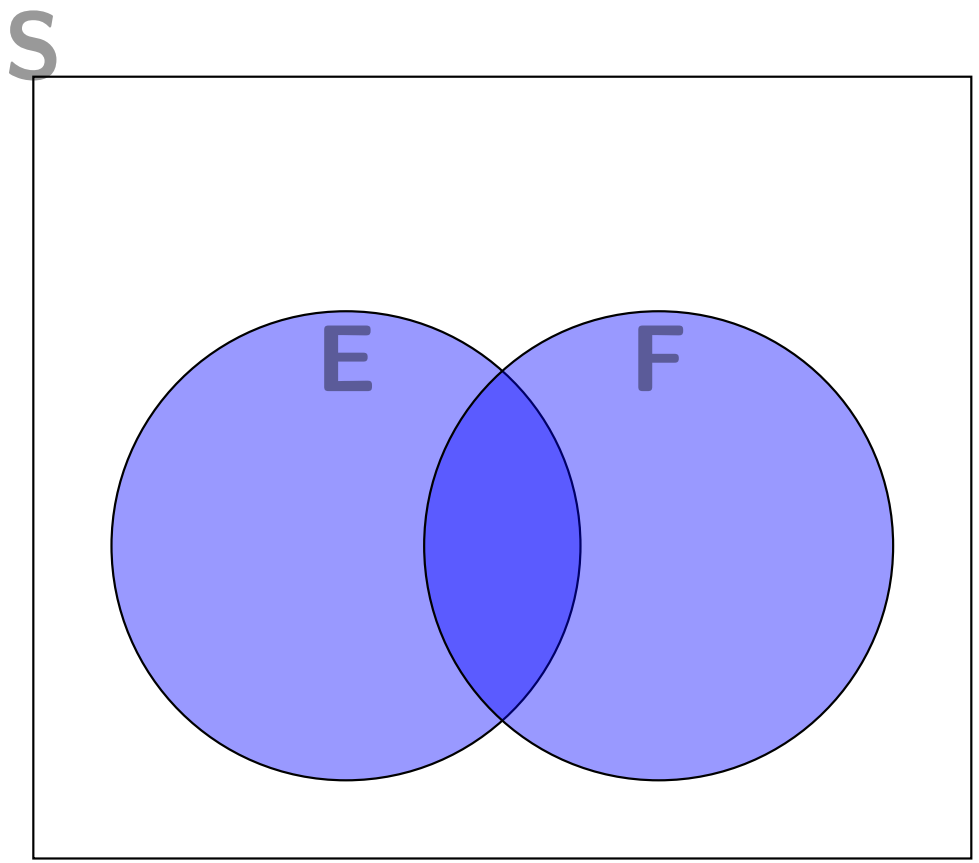
Representation of event

- Representation of event: The events $E, F, G, \ldots$ are represented in given circles within the rectangle.

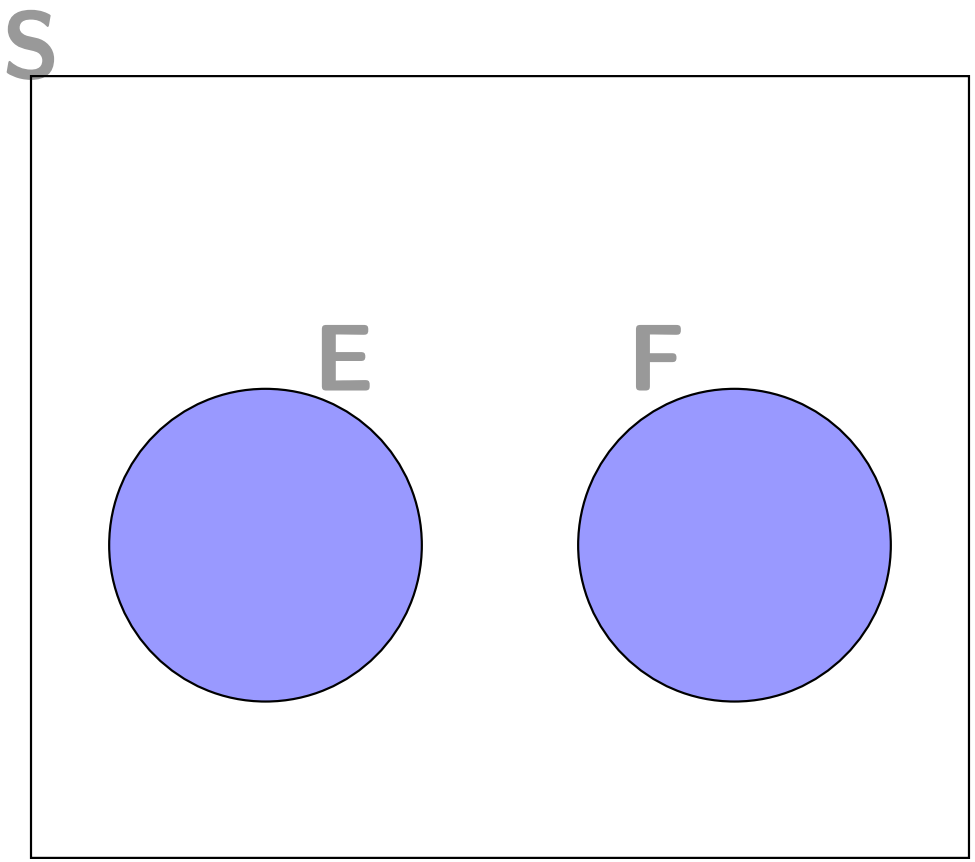


Representation of event: union and intersection

- Representation of event:
  - $E \cup F$ is entire shaded region
  - $E \cap F$ is the shaded in blue region

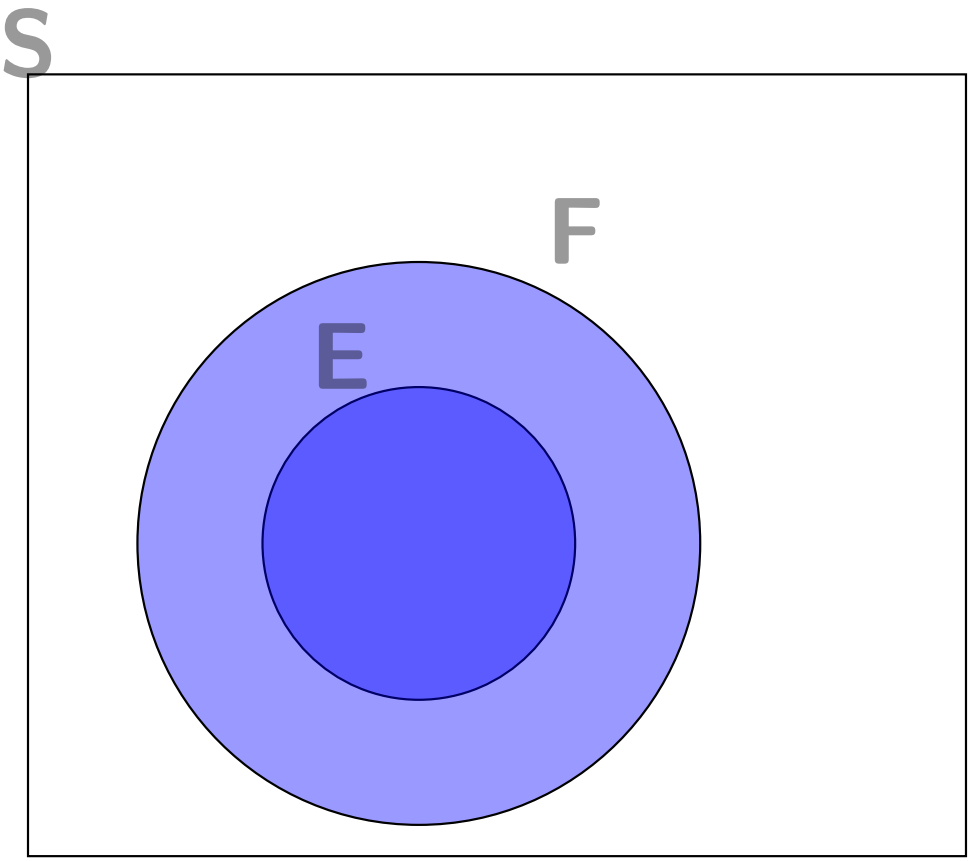


Representation of event: disjoint events



Representation of event: subsets

$E \subset F$



Topic summary

1. Introduced random experiment, sample space, event.
2. Notion of union, intersection, complement of events.
3. Representation of sample space, events, using venn diagrams.