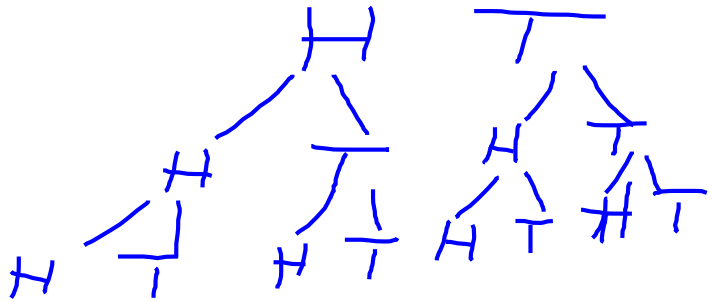
Probability

Section 9.7

The Probability of an Event

- P(E) – The probability of an event = $\frac{Successes}{Outcomes}$
- Can be expressed as a fraction, decimal or percent. $0 \leq P(E) \leq 1$

Describe the sample space for tossing a coin three times.



- Sample Space (S) is the set of all possible outcomes of the experiment.
- Set Notation S = { HHH, HHT, HTH, HTT, THH, THT, TTH, TTT }

Prob of exactly 2 heads $\frac{3}{8}$

Probability

- Mutually Exclusive
  - The events are disjoint
  - Events do not share any possible outcome

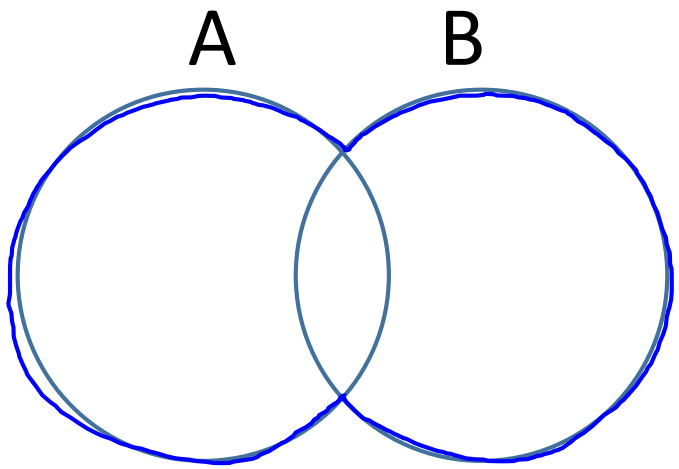
- Independent Events
  - Occurrence of one has no effect on the occurrence of the other
  - The probability doesn't change
  - (with Replacement)

- Complement
  - Let A be an event and let A' be its complement. If the probability of event A is P(A), the probability of the complement is
  - $P(A') = 1 - P(A)$

Probability Notation

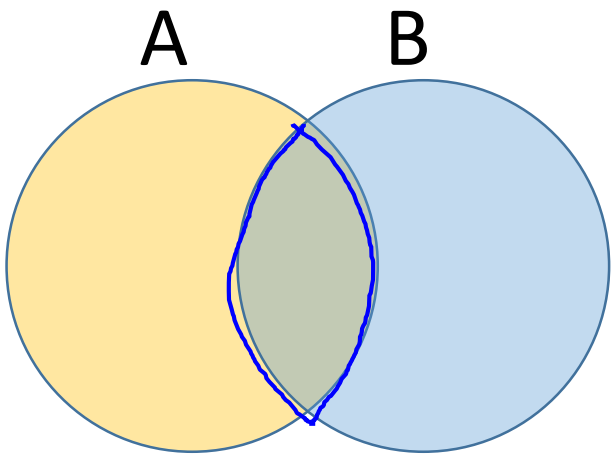
Union

- Symbol - $\cup$
  - $A \cup B$ means “A or B”



Intersection

- Symbol -$\cap$
  - $A \cap B$ means “A and B”

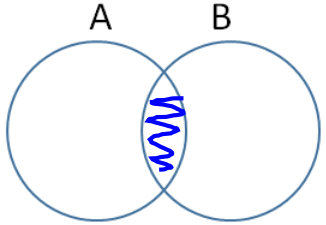


Probability Rules

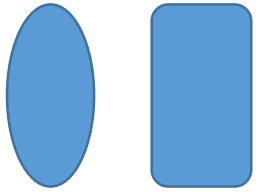
If A and B are events in the same sample space, the probability of A or B occurring is given by

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

(or means add)



If A and B are mutually exclusive (disjoint), then $P(A \cup B) = P(A) + P(B)$



If A and B are independent events, the probability that both A and B will occur is

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

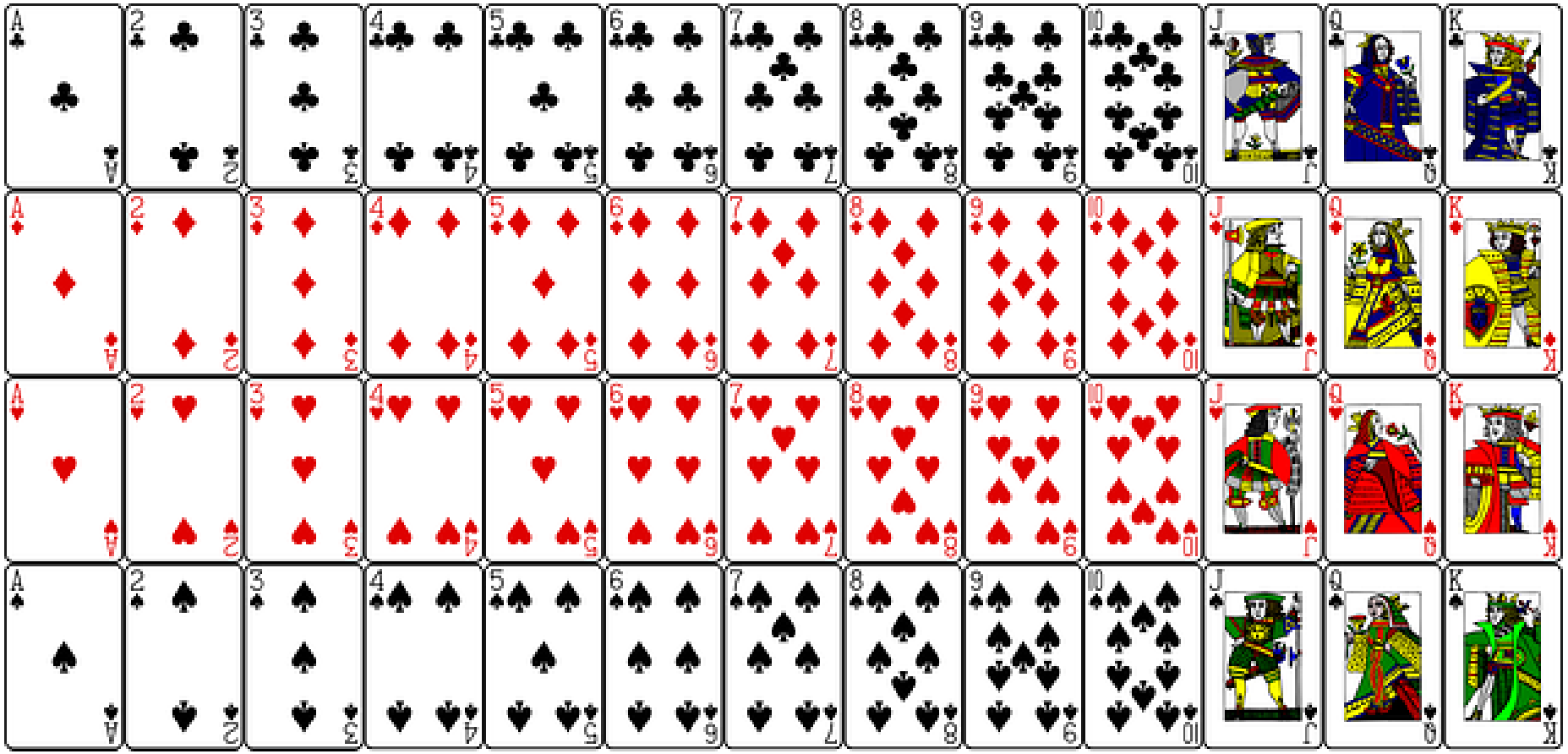
(and means multiply)

If you draw a card from a standard deck of playing cards, what is the probability that the card is a heart or a club?

$\frac{13}{52} + \frac{13}{52}$

$\frac{1}{4} + \frac{1}{4}$

$\frac{1}{2}$

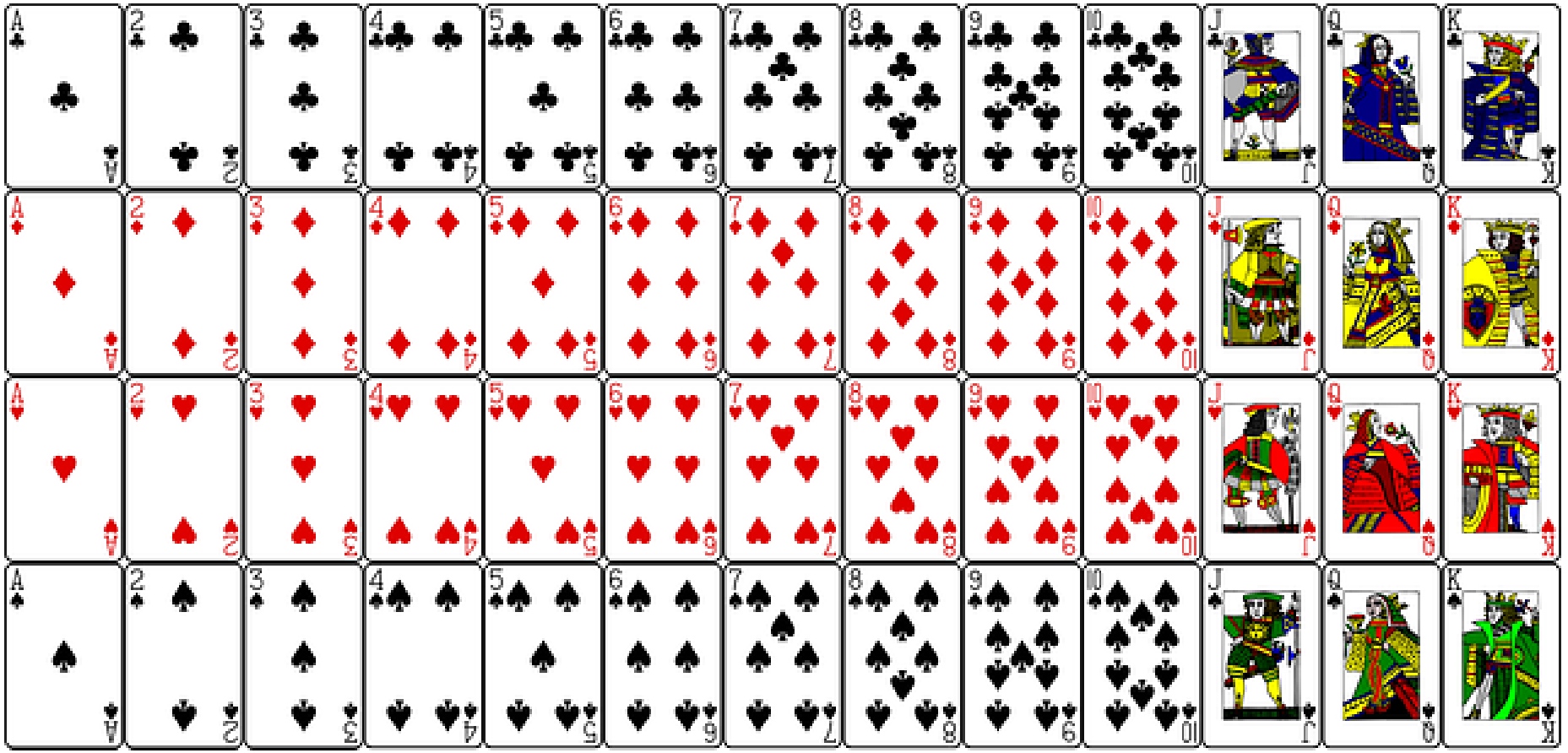


If you draw a card from a standard deck of playing cards, what is the probability that the card is a heart or a face card?

$\frac{13}{52} + \frac{12}{52} - \frac{3}{52}$

$\frac{25-3}{52}$

$\frac{22}{52}$ $\frac{11}{26}$

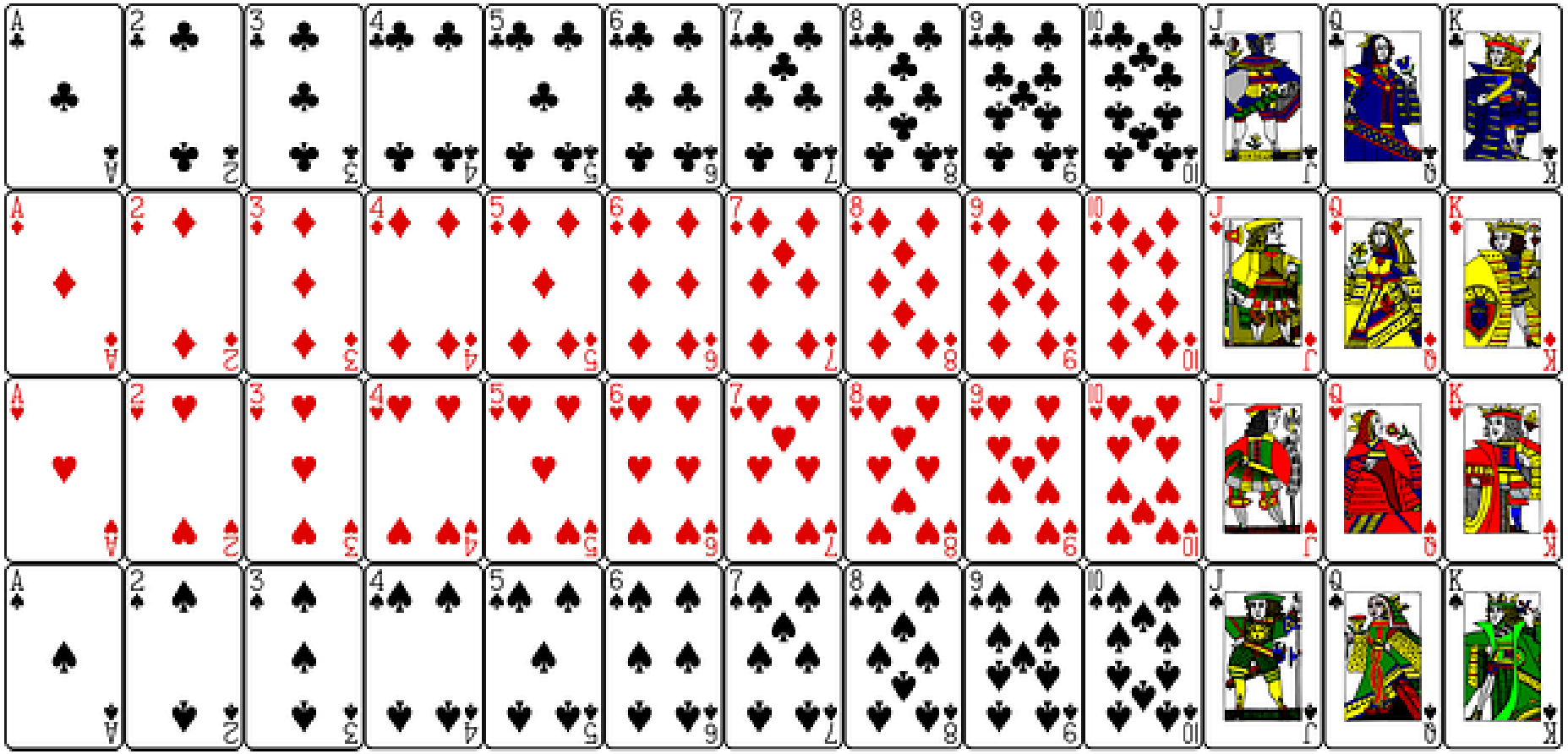


If you draw a card and roll a die, what is the probability that the card and die are 6's?

$\frac{4}{52} \cdot \frac{1}{6}$

$\frac{1}{13} \cdot \frac{1}{6} =$

$\frac{1}{78}$



Probability of Independent Events

The occurrence of one has no effect on the occurrence of the other.

A sales rep makes a sale at approximately one-third of all calls. If the rep contacts five potential clients on a given day, what is the probability a sale will be made with all five contacts?

$\frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} = \frac{1}{243} \approx .004$

A class is given a list of 20 problems from which 10 will be part of an upcoming exam. A student knows how to solve 15 of them. Find the probabilities that the student will be able to answer

a. All 10 questions on the exam

$\frac{\text{Succ}}{\text{total}}$ $\frac{{}_{15}C_{10}}{{}_{20}C_{10}}$ $\frac{3003}{184{,}756} = .016$

b. At least 9 questions on the exam

9 or 10

$\frac{{}_{15}C_{9} \cdot {}_{5}C_{1}}{{}_{20}C_{10}} + \frac{{}_{15}C_{10}}{{}_{20}C_{10}} \approx .152$

Section 9.7 p. 670; 7-39 odd, 43, 45