

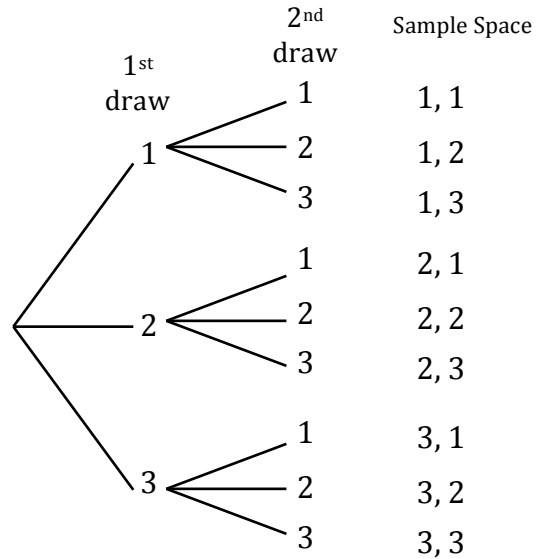
**3.5 Tree and Venn Diagrams**

**Tree Diagrams**



Recall, again, our example of drawing two cards from a set of 3 cards.

We organized our sample space using a tree diagram.

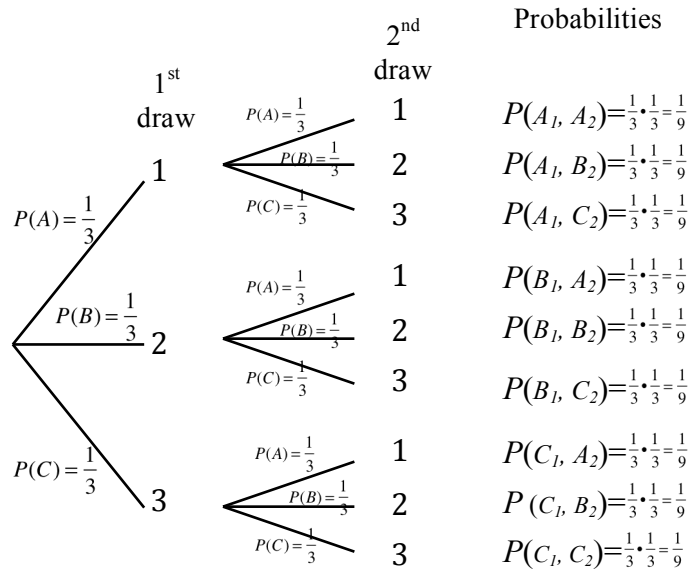


We can also use the same tree diagram to determine probabilities of events.

Let  $A = \{1\}$ .

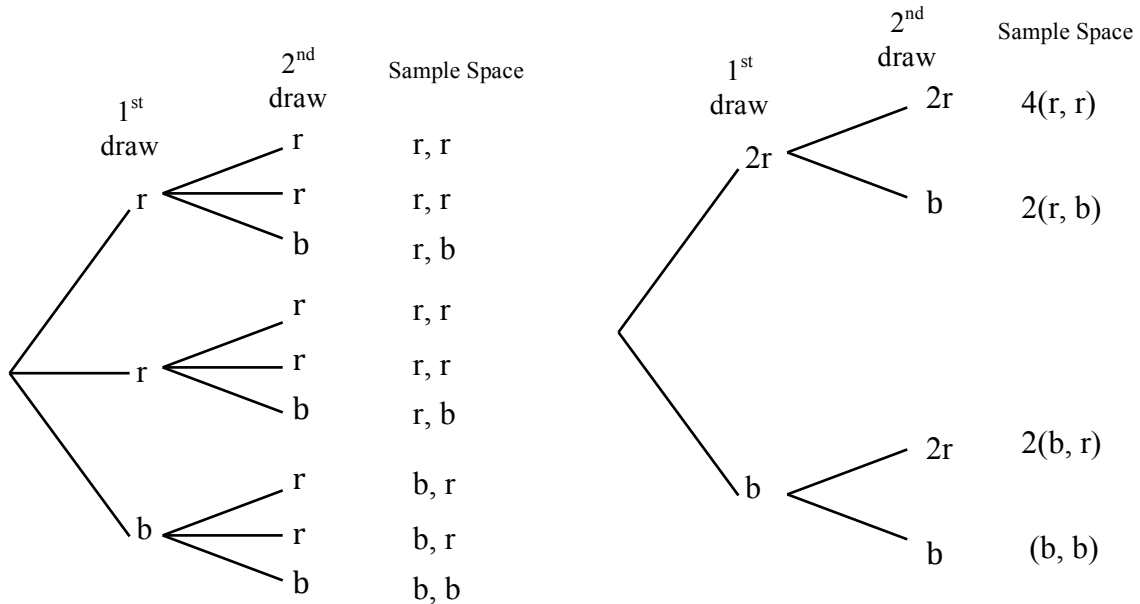
Let  $B = \{2\}$ .

Let  $C = \{3\}$ .

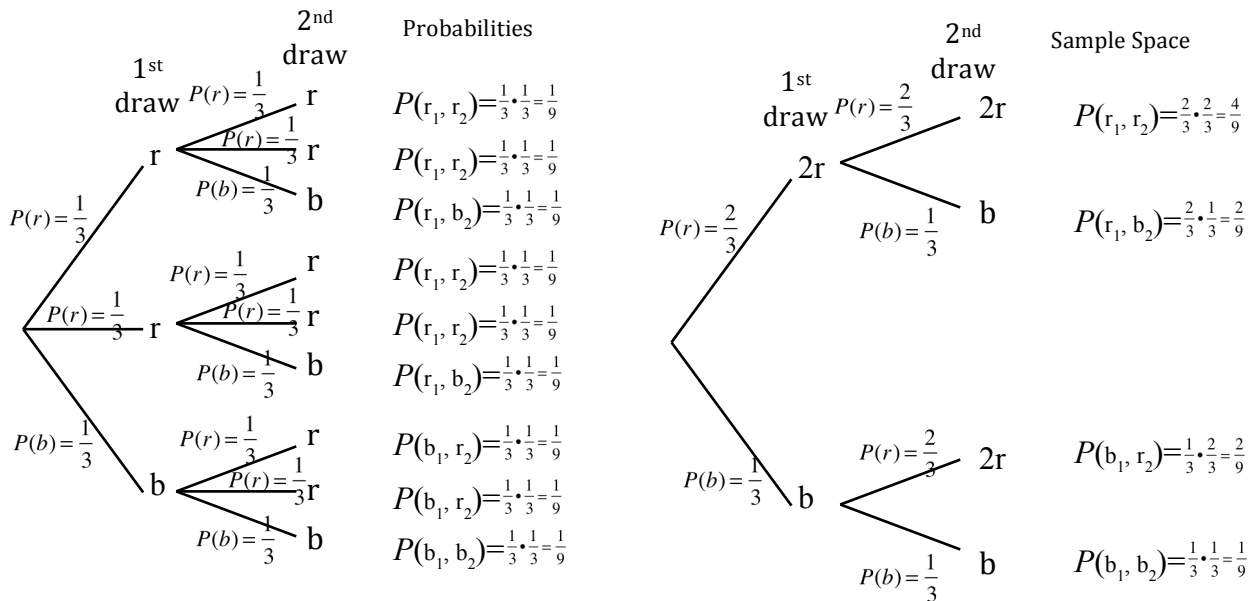


Suppose that, of the 3 cards, 2 of them are red, and 1 of them is black. Compare the sample space tree diagrams for this variation below:

Let  $r = \{\text{red}\}$ ;  $b = \{\text{black}\}$ .



The following tree diagrams contain probabilities in addition to event and sample spaces.

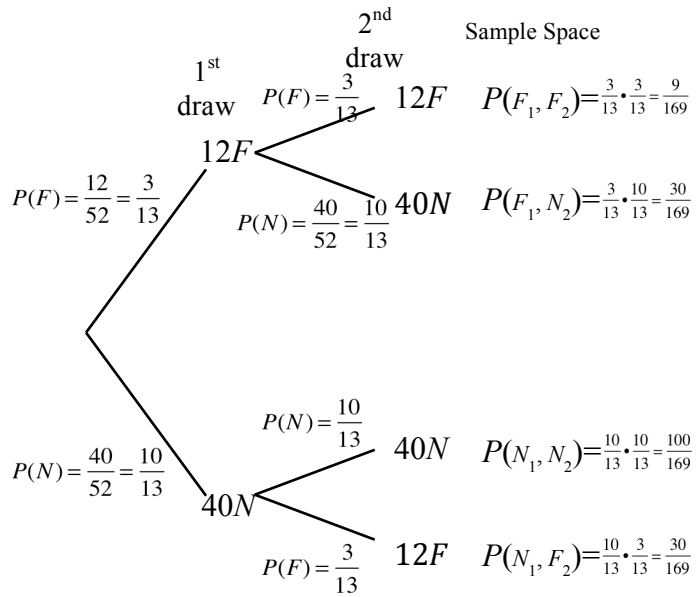


The condensed tree diagram can be very useful in determining probabilities for an experiment in which the sample space and event space are very large.

Suppose we want to find the probability of drawing, **with** replacement, two face cards from a standard 52-card deck.

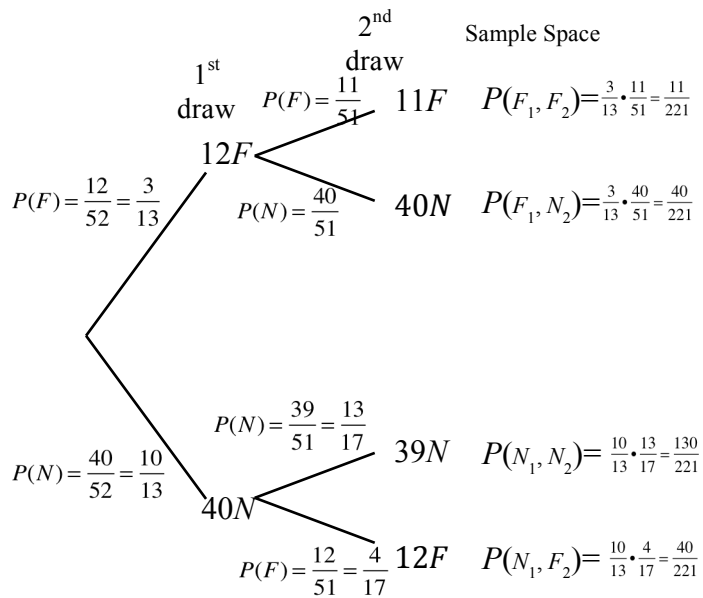
Let  $F = \{\text{face cards}\}$ .  
 Let  $N = \{\text{non-face cards}\}$

$$P(F_1, F_2) = \frac{9}{169}$$



Suppose we draw the two cards **without** replacement. We can use the tree diagram to determine the probability of drawing 2 face cards for this case also.

$$P(F_1, F_2) = \frac{11}{221}$$



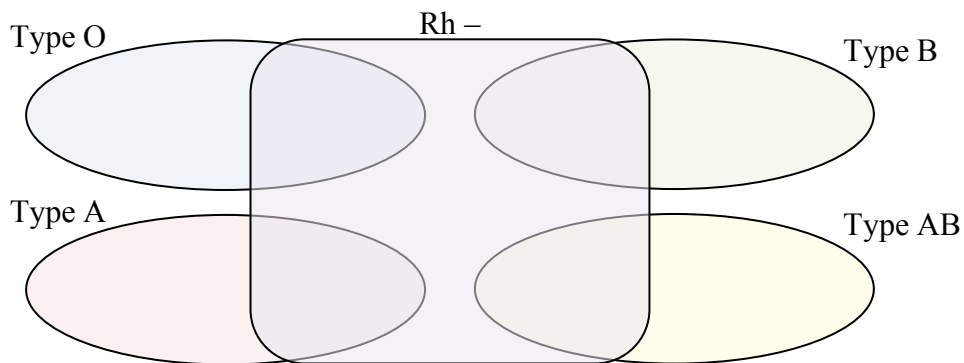
### Venn Diagrams

A *venn diagram* is a diagram representing mathematical sets enclosed in circles within a rectangle, the universal set, common elements of the sets being represented by the areas of overlap among the circles.

Venn diagrams can be used to organize sample spaces in a way that aids in finding particular event probabilities.

Suppose we know the percentages of all people that have the following blood types:

- |                          |                          |
|--------------------------|--------------------------|
| • O-positive: 38 percent | • B-positive: 9 percent  |
| • O-negative: 7 percent  | • B-negative: 2 percent  |
| • A-positive: 34 percent | • AB-positive: 3 percent |
| • A-negative: 6 percent  | • AB-negative: 1 percent |



What is the probability that a randomly chosen person has type O blood?

What is the probability that a randomly chosen person has type Rh+ blood?