1. Judgemental; the probability is an opinion.

2. Empirical; the probability is based on past data.

3. Logical; the probability is based on theory.

4. Judgemental; the probability is an opinion.

5. The probability distribution is as follows:

Number of Heads	Probability
0	$\frac{1}{4}$
1	$\frac{2}{4}=\frac{1}{2}$
2	$\frac{1}{4}$

6. The probability distribution is as follows:

Letter	Probability
A	$\frac{1}{7}$
B	$\frac{1}{7}$
C	$\frac{3}{7}$
D	$\frac{2}{7}$

7. $\frac{1}{38}+\frac{1}{38}=\frac{2}{38}=\frac{1}{19}$

8. $\frac{6}{50}=\frac{3}{25}$

9. a. $\frac{191}{4487}\approx 0.04257$

   b. $\frac{191+81}{4487}=\frac{272}{4487}\approx 0.06062$

   c. $\frac{4487-272}{4487}=\frac{4215}{4487}\approx 0.9394$

10. a. $\frac{54}{193}\approx 0.2798$

    b. $\frac{54+23}{193}=\frac{77}{193}\approx 0.3990$

    c. $\frac{193-77}{193}=\frac{116}{193}\approx 0.6010$

11. a. $\frac{6}{26}=\frac{3}{13}\approx 0.2308$

    b. $\frac{5}{26}\approx 0.1923$

    c. $\frac{6+5-2}{26}=\frac{9}{26}\approx 0.3462$

12. a. $\frac{3}{9}=\frac{1}{3}\approx 0.3333$

    b. $\frac{5}{9}\approx 0.5556$

    c. The probability of a 1, 2, 3, 5, 7, or 9 is $\frac{6}{9}=\frac{2}{3}\approx 0.6667$.

13. a. E = "the numbers add up to 9" = {(3, 6), (4, 5), (5, 4), (6, 3)}
    $\Pr(E)=\frac{4}{36}=\frac{1}{9}\approx 0.1111$

    b. $\Pr(\text{sum is } 2)=\Pr((1,1))=\frac{1}{36}$;
    $\Pr(\text{sum is } 3)=\Pr((1,2))+\Pr((2,1))=\frac{2}{36}$
    $\Pr(\text{sum is } 4)=\Pr((1,3))+\Pr((2,2))+\Pr((3,1))=\frac{3}{36}$
    The probability that the sum is less than 5 is $\frac{1}{36}+\frac{2}{36}+\frac{3}{36}=\frac{1}{6}\approx 0.1667$.

14. a. $\Pr(\text{at least two boys}) = \frac{4}{8} = \frac{1}{2} = 0.5$

b. $\Pr(\text{Oldest is a girl}) = \frac{1}{2} = 0.5$

15.

Kind of High School	Probability
Public	$\frac{115620}{141000} = 0.820$
Private	$\frac{24252}{141000} = 0.172$
Home School	$\frac{1128}{141000} = 0.008$

16.

Highest Academic Degree Planned	Probabilities
Master's	$\frac{59361}{141000} = 0.421$
Bachelor's	$\frac{29751}{141000} = 0.211$
Ph.D or Ed. D	$\frac{26931}{141000} = 0.191$
M.D, D.O., D.D.S., D.V.M.	$\frac{15792}{141000} = 0.112$
Other	$\frac{9165}{141000} = 0.065$

17. $\Pr(B, C, \text{ or } D) = 0.34 + 0.21 + 0.09 = 0.64$

18. $0.13 + 0.13 + 0.20 = 0.46$

19. a. $\Pr(E) = 0.1 + 0.5 = 0.6$;
$\Pr(F) = 0.5 + 0.2 = 0.7$

b. $\Pr(E') = 1 - 0.6 = 0.4$

c. $\Pr(E \cap F) = 0.5$

d. $\Pr(E \cup F) = 0.6 + 0.7 - 0.5 = 0.8$

20. a. $\Pr(E) = 0.05 + 0.25 = 0.3$;
$\Pr(F) = 0.05 + 0.63 + 0.01 = 0.69$

b. $\Pr(E') = 1 - 0.3 = 0.7$

c. $\Pr(E \cap F) = 0$

d. $\Pr(E \cup F) = 0.3 + 0.69 = 0.99$

21. a.

Number of Colleges Applied to	Probability
1	0.10
2	$0.17 - 0.10 = 0.07$
3	$0.27 - 0.17 = 0.10$
4	$0.40 - 0.27 = 0.13$
≥ 5	$1 - 0.40 = 0.60$

b. $0.10 + 0.13 + 0.60 = 0.83$

22. a.

Age (in Years)	Probability
20 – 34	.15
35 – 49	$0.70 - 0.15 = 0.55$
50 – 64	$0.90 - 0.70 = 0.20$
65 - 79	$1 - 0.90 = 0.10$

b. $0.20 + 0.10 = 0.30$

23. a. No; The probabilities add to more than 1.

b. No; One of the probabilities is a negative value.

c. No; The probabilities do not add to 1.

24. **a.** No; The probabilities do not add 1.

b. No; One of the probabilities is a negative value.

c. Yes; The probabilities are positive and they add to 1.

25. $1-\left(\frac{2}{3}+\frac{1}{4}\right)=\frac{1}{12}$

26. **a.** $1-0.17-0.47-0.20=0.16$

b. $0.17+0.47=0.64$

c. $1-0.20=0.80$

27. $\Pr(\text{Liberal})=.28;\quad \Pr(\text{middle})=2x;$
$\Pr(\text{Conseravtive})=x$

$$0.28+2x+x=1$$
$$3x=0.72$$
$$x=0.24$$

28. $\Pr(\text{Alice wins})=2x;\quad \Pr(\text{Ben wins})=x$

$$2x+x=1$$
$$3x=1$$
$$x=\tfrac{1}{3}$$

$\Pr(\text{Alice wins})=\frac{2}{3};\quad \Pr(\text{Ben wins})=\frac{1}{3}$

29. The probability is 1 because the sum of a pair of dice must be odd or even.

30. The probability is 1 because the number of heads must be odd or even.

31. $\Pr(E\cup F)=\Pr(E)+\Pr(F)$
$=0.4+0.5$
$=0.9$

32. $\Pr(F)=\Pr(E\cup F)-\Pr(E)$
$=0.7-0.3$
$=0.4$

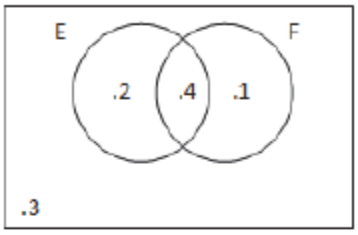
33. $\Pr(S)=0.05+0.40=0.45$

34. $\Pr(\text{Exactly 1 event})=0.05+0.25=0.30$

35. $\Pr(T \text{ only})=0.25$

36. $\Pr(S')=1-0.45=0.55$

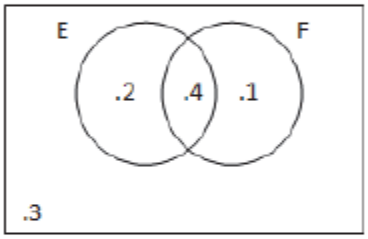
37.



a. $\Pr(E\cup F)=0.2+0.4+0.1=0.7$

b. $\Pr(E\cap F')=0.2$

38.



a. $\Pr(E\cap F)=0.4$

b. $\Pr(E\cup F')=0.2+0.4+0.3=0.9$

39. $\Pr(H\cap P)=\Pr(H)+\Pr(P)-\Pr(H\cup P)$
$=0.7+0.8-0.9$
$=0.6$

40. $\Pr(M\cap C)=\Pr(M)+\Pr(C)-\Pr(M\cup C)$
$=\frac{1}{2}+\frac{3}{8}-\frac{3}{4}$
$=\frac{1}{8}$

41. $10 \text{ to } 1=\dfrac{10}{10+1}=\dfrac{10}{11}$

42. $4 \text{ to } 5=\dfrac{4}{4+5}=\dfrac{4}{9}$

43. $.2=\dfrac{1}{5}\Rightarrow 1 \text{ to } (5-1)=1 \text{ to } 4$

44. $\frac{3}{7} \Rightarrow 3 \text{ to } (7-3) = 3 \text{ to } 4$

45. $.3125 = \frac{5}{16} \Rightarrow 5 \text{ to } (16-5) = 5 \text{ to } 11$

46. $.05 = \frac{1}{20} \Rightarrow 1 \text{ to } (20-1) = 1 \text{ to } 19$

47. $2 \text{ to } 9 = \frac{2}{2+9} = \frac{2}{11}$

48. $2 \text{ to } 5 = \frac{2}{2+5} = \frac{2}{7}$

49. **a.** Sparks: $5 \text{ to } 3 = \frac{3}{5+3} = \frac{3}{8}$

Meteors: $3 \text{ to } 1 = \frac{1}{3+1} = \frac{1}{4}$

Asteroids: $3 \text{ to } 2 = \frac{2}{3+2} = \frac{2}{5}$

Suns: $4 \text{ to } 1 = \frac{1}{4+1} = \frac{1}{5}$

b. $\frac{3}{8} + \frac{1}{4} + \frac{2}{5} + \frac{1}{5} = \frac{15}{40} + \frac{10}{40} + \frac{16}{40} + \frac{8}{40}$

$= \frac{49}{40}$

c. Bookies have to make a living. The payoffs are a little lower than they should be; thus allowing the bookie to make a profit.

50. $.63 = \frac{63}{100} \Rightarrow 63 \text{ to } (100-63) = 63 \text{ to } 37$

51. There are more members (13) than Zodiac signs (12) so two or more members will always have the same Zodiac sign; thus the probability is 1.

52. This event never occurs; if 5 of the people receive the correct coat then so must the remaining person. Thus the probability is 0.