⑦ $E(X) = x_1 p_1 + x_2 p_2 + x_3 p_3$

$= -3(0.3) + 0(0.5) + 4(0.2)$

$= -0.1$

Could also write $\mu = -0.1$

The expected value is -0.1

⑨ Let X = winnings ($)

X	$P(x)$
5	1/4
20	1/4
50	1/4
100	1/4

$E(X) = 5\left(\frac{1}{4}\right) + 20\left(\frac{1}{4}\right) + 50\left(\frac{1}{4}\right) + 100\left(\frac{1}{4}\right)$

$= 43.75$

Could also write $\mu = 43.75$

The expected value is \$43.75

(11) Let X = winnings (\$)

	X	$P(x)$
(penny)	0.01	15/50
(dime)	0.10	10/50
(quarter)	0.25	25/50

$$E(X) = 0.01\left(\frac{15}{50}\right) + 0.10\left(\frac{10}{50}\right) + 0.25\left(\frac{25}{50}\right)$$

$$\approx 0.15$$

Could also write $\mu \approx 0.15$

The expected value is approximately \$0.15

(15) Let X = number of heads

X	Description	Number of Ways	P(X)
0	TT	1	1/4
1	HT, TH	2	2/4
2	HH	1	1/4

Total = 4

$$E(X) = 0\left(\frac{1}{4}\right) + 1\left(\frac{2}{4}\right) + 2\left(\frac{1}{4}\right)$$

$$= 1$$

Could also write $\mu = 1$.

The expected number of heads is 1.

17 Let X = winnings ($)

	X	$P(X)$
(head)	1	$\frac{1}{2}$
(tail)	-1	$\frac{1}{2}$

$$E(X) = 1\left(\tfrac{1}{2}\right) + (-1)\left(\tfrac{1}{2}\right)$$
$$= 0$$

Could also write $\mu = 0$.

The expected value is \$0.

The game is fair because $E(X) = 0$.

(19) Let X = net winnings (\$)

$= (\text{dollars won}) - 4$

we are paying \$4 to play

	X	$P(x)$
(roll a 1)	$1-4=-3$	$1/6$
(roll a 2)	$2-4=-2$	$1/6$
(roll a 3)	-1	
(roll a 4)	0	
(roll a 5)	1	
(roll a 6)	$6-4=2$	$1/6$

$$E(X) = -3\left(\tfrac{1}{6}\right) + (-2)\left(\tfrac{1}{6}\right) + (-1)\left(\tfrac{1}{6}\right) + 0\left(\tfrac{1}{6}\right) + 1\left(\tfrac{1}{6}\right) + 2\left(\tfrac{1}{6}\right)$$

$$= -0.5$$

Could also write $\mu = -0.5$

The expected value is $-\$0.50$

The game is not fair because $E(X) \neq 0$

(21) Let X = winnings (\$)

X	Description	Number of Ways	$P(x)$
2	HH, TT	2	2/4
−3	HT, TH	2	2/4
		Total = 4	

$$E(X) = 2\left(\frac{2}{4}\right) + (-3)\left(\frac{2}{4}\right)$$
$$= -0.5$$

Could also write $\mu = -0.5$

The expected value is $-\$0.50$

(25) Let X = winnings ($)

X	Description	Number of Ways	P(X)
5	1, 2	2	2/6
10	3, 4, 5	3	3/6
k	6	1	1/6

Total = 6

We want the game to be fair.

$$E(X) = 0$$

$$5\left(\frac{2}{6}\right) + 10\left(\frac{3}{6}\right) + k\left(\frac{1}{6}\right) = 0$$

$$\frac{10}{6} + \frac{30}{6} + \frac{k}{6} = 0$$

Multiply by 6:

$$10 + 30 + k = 0$$

$$40 + k = 0$$

$$k = -40$$

We should lose $40.

(29) X = winnings (\$)

X	Description	Number of ways	$P(X)$
10	King	4	$4/52$
-1	non-King	48	$48/52$

Total = 52

$$E(X) = 10\left(\frac{4}{52}\right) + (-1)\left(\frac{48}{52}\right)$$

$$\approx -0.15$$

Could also write $\mu \approx -0.15$

The expected value is approximately $-\$0.15$

(41) a) X = number of defective bulbs chosen

Let D stand for defective; let G stand for good.

Box: | 3 D / 7 G |

X	Description	Number of Ways	$P(X)$
0	2 G	$_7C_2 = 21$	$21/45$
1	1D and 1G	$_3C_1 \times {_7C_1} = 21$	$21/45$
2	2D	$_3C_2 = 3$	$3/45$

Total = 45

b) $E(X) = 0\left(\frac{21}{45}\right) + 1\left(\frac{21}{45}\right) + 2\left(\frac{3}{45}\right)$

$= 0.6$

Could also write $\mu = 0.6$

The expected number of defective bulbs is 0.6