

## 11.5 De verwachtingswaarde

### Opgave 70:

$U$ =uitbetaling,  $W$ =winst

$U$	2000	20	0
$P$	0,001	0,1	0,899

$$E(U) = 0,001 \cdot 2000 + 0,1 \cdot 20 = 4$$

$$E(W) = 5 - 4 = 1 \text{ per lot}$$

dus  $1000 \cdot 1 = 1000$  euro

### Opgave 71:

a.

$U$	50	10	0
$P$	0,01	0,03	0,96

$$E(U) = 0,01 \cdot 50 + 0,03 \cdot 10 = 0,8$$

$$E(W) = 0,8 - 2 = -1,2$$

b. € 0,80 (de verwachte uitbetaling)

### Opgave 72:

$U$	25	10	0
$P$	$\frac{1}{20}$	$\frac{2}{20}$	$\frac{17}{20}$

$$E(U) = 25 \cdot \frac{1}{20} + 10 \cdot \frac{2}{20} = 2,25 \text{ euro}$$

### Opgave 73:

a.

$U$	100	50	25	10	0
$P$	0,001	0,005	0,01	0,025	0,959

$$E(U) = 100 \cdot 0,001 + 50 \cdot 0,005 + 25 \cdot 0,01 + 10 \cdot 0,025 = 0,85$$

$$E(W) = 0,85 - 1 = -0,15$$

b.  $500 \cdot 0,15 = 75$  dollar

### Opgave 74:

a. 
$$\frac{1}{10 \cdot 9 \cdot 8 \cdot 7} = \frac{1}{5040}$$

b.

$U$	10000	0
$P$	$\frac{1}{5040}$	$\frac{5039}{5040}$

$$E(U) = 10000 \cdot \frac{1}{5040} = 1,98$$

$$E(W) = 1,98 - 2,50 = -0,52$$

c.  $20000 \cdot 0,52 - 7500 = 2900$

**Opgave 75:**

$$a. \frac{1}{6} \cdot \left(\frac{5}{6}\right)^2 \cdot \binom{3}{1} = \frac{75}{216}$$

$$b. \left(\frac{1}{6}\right)^2 \cdot \frac{5}{6} \cdot \binom{3}{2} = \frac{15}{216}$$

$$c. \left(\frac{5}{6}\right)^3 = \frac{125}{216}$$

d.

$U$	3	2	1	0
$P$	$\frac{1}{216}$	$\frac{15}{216}$	$\frac{75}{216}$	$\frac{125}{216}$

$$E(U) = 3 \cdot \frac{1}{216} + 2 \cdot \frac{15}{216} + 1 \cdot \frac{75}{216} = 0,5$$

$$E(W) = 1 - 0,5 = 0,5$$

$$500 \cdot 0,5 = 250 \text{ dollar}$$

**Opgave 76:**

$$a. P(\text{som} = 5) = \frac{6}{216}$$

$$P(\text{som} = 6) = \frac{10}{216}$$

$$P(\text{€ } 20) = \frac{16}{216}$$

$$b. P(X = 0) = \text{binompdf}(5, \frac{16}{216}, 0) = 0,681$$

$$c. \left(\frac{200}{216}\right)^5 \cdot \frac{16}{216} = 0,050$$

$$d. P(\text{€ } 100) = \frac{3}{216}$$

$$P(\text{€ } 30) = \frac{6+3+1}{216} = \frac{10}{216}$$

$U$	100	30	20	0
$P$	$\frac{3}{216}$	$\frac{10}{216}$	$\frac{16}{216}$	$\frac{187}{216}$

$$E(U) = 100 \cdot \frac{3}{216} + 30 \cdot \frac{10}{216} + 20 \cdot \frac{16}{216} = 4,26$$

$$E(W) = 5 - 4,26 = 0,74$$

$$800 \cdot 0,74 = 592,59 \text{ euro}$$

**Opgave 77:**

$$a. P(X = 2) = \text{binompdf}(3, 0,4, 2) = 0,288$$

$$b.$$

$U$	0	6,5	13	19,5
$P$	0,216	0,432	0,288	0,064

$$E(U) = 0,432 \cdot 6,5 + 0,288 \cdot 13 + 0,064 \cdot 19,5 = 7,8$$

$$E(W) = 20 - 7,8 = 12,2$$

$$228 \cdot 12,2 = 2781,60 \text{ euro}$$

**Opgave 78:**

a.  $P(Z = 4) = \frac{3}{36}$

b.

Z	2	3	4	5	6	7	8	9	10	11	12
P	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

$$E(Z) = 2 \cdot \frac{1}{36} + 3 \cdot \frac{2}{36} + 4 \cdot \frac{3}{36} + 5 \cdot \frac{4}{36} + 6 \cdot \frac{5}{36} + 7 \cdot \frac{6}{36} + 8 \cdot \frac{5}{36} + 9 \cdot \frac{4}{36} + 10 \cdot \frac{3}{36} + 11 \cdot \frac{2}{36} + 12 \cdot \frac{1}{36} = 7$$

c.  $E(X) = 1 \cdot \frac{1}{6} + 2 \cdot \frac{1}{6} + 3 \cdot \frac{1}{6} + 4 \cdot \frac{1}{6} + 5 \cdot \frac{1}{6} + 6 \cdot \frac{1}{6} = 3,5$

$$E(Y) = 1 \cdot \frac{1}{6} + 2 \cdot \frac{1}{6} + 3 \cdot \frac{1}{6} + 4 \cdot \frac{1}{6} + 5 \cdot \frac{1}{6} + 6 \cdot \frac{1}{6} = 3,5$$

ja,  $E(X + Y) = E(X) + E(Y)$ **Opgave 79:**

a.  $E(X) = 1 \cdot 0,05 + 2 \cdot 0,25 + 3 \cdot 0,4 + 4 \cdot 0,25 + 5 \cdot 0,05 = 3$

$$E(Y) = 1 \cdot 0,3 + 2 \cdot 0,15 + 3 \cdot 0,1 + 4 \cdot 0,15 + 5 \cdot 0,3 = 3$$

b. histogram Y

**Opgave 80:**

a.  $L1 = \{1,2,3,4,5\}$

$$L2 = \{0,05,0,15,0,60,0,15,0,05\}$$

$$1 - VAR \text{ STATS } L1, L2 \text{ geeft } E(X) = 3 \quad \sigma_X = 0,84$$

b.  $L1 = \{1,2,3,4,5\}$

$$L2 = \{0,30,0,15,0,10,0,15,0,30\}$$

$$1 - VAR \text{ STATS } L1, L2 \text{ geeft } E(X) = 3 \quad \sigma_X = 1,64$$

**Opgave 81:**

$$L1 = \{498,198,3,-2\}$$

$$L2 = \{0,001,0,002,0,1,0,897\}$$

$$1 - VAR \text{ STATS } L1, L2 \text{ geeft } E(X) = -0,6 \quad \sigma_X = 18,18$$

**Opgave 82:**

a.  $E(T) = E(X) + E(Y) = 16 + 30 = 46 \text{ sec}$

b.  $\sigma_T = \sqrt{\sigma_X^2 + \sigma_Y^2} = \sqrt{2^2 + 3^2} = \sqrt{13} = 3,6 \text{ sec}$

**Opgave 83:**

$$E(B) = E(N) + E(T) = 230 + 30 = 260 \text{ gram}$$

$$\sigma_B = \sqrt{\sigma_N^2 + \sigma_T^2} = \sqrt{12^2 + 5^2} = \sqrt{169} = 13 \text{ gram}$$

**Opgave 84:**a. op een dobbelsteen zijn de ogen op twee tegenover elkaar liggende vlakken altijd samen 7  
dus voor iedere worp geldt:  $X + Y = 7$ dus  $\sigma_{X+Y} = 0$  omdat alle uitkomsten hetzelfde zijn

b. X en Y zijn niet onafhankelijk, want als je X weet, dan weet je ook Y