

## 11.4 Binomiale kansen gebruiken

### Opgave 48:

- a.
  1.  $P(X \leq 5)$
  2.  $P(X = 4)$
  3.  $P(X \geq 7)$
- b.
  1.  $P(X \geq 10) = 1 - P(X \leq 9)$
  2.  $P(X > 5) = 1 - P(X \leq 5)$
  3.  $P(X < 7) = P(X \leq 6)$
  4.  $P(X \geq 6) = 1 - P(X \leq 5)$

### Opgave 49:

- a.  $P(X \leq 8) - P(X \leq 4)$
- b.  $P(X \leq 6) - P(X \leq 1)$
- c.  $P(5 \leq X \leq 10) = P(X \leq 10) - P(X \leq 4)$   
 $P(4 < X < 9) = P(X \leq 8) - P(X \leq 4)$

### Opgave 50:

- a.  $P(X > 2) = 1 - P(X \leq 2)$
- b.  $P(X \geq 10) = 1 - P(X \leq 9)$
- c.  $P(3 < X < 8) = P(X \leq 7) - P(X \leq 3)$
- d.  $P(X \text{ tussen } 2 \text{ en } 11) = P(X \leq 10) - P(X \leq 2)$
- e.  $P(X \geq 8) = 1 - P(X \leq 7)$
- f.  $P(2 \leq X \leq 9) = P(X \leq 9) - P(X \leq 1)$

### Opgave 51:

- a.  $P(X < 10) = P(X \leq 9) = \text{binomcdf}(25, 0.42, 9) = 0,347$
- b.  $P(X \geq 8) = 1 - P(X \leq 7) = 1 - \text{binomcdf}(25, 0.42, 7) = 0,889$
- c.  $P(9 < X < 16) = P(X \leq 15) - P(X \leq 9)$   
 $= \text{binomcdf}(25, 0.42, 15) - \text{binomcdf}(25, 0.42, 9) = 0,631$
- d.  $P(X \geq 6) = 1 - P(X \leq 5) = 1 - \text{binomcdf}(25, 0.42, 5) = 0,982$
- e.  $P(7 < X < 12) = P(X \leq 11) - P(X \leq 7)$   
 $= \text{binomcdf}(25, 0.42, 11) - \text{binomcdf}(25, 0.42, 7) = 0,550$
- f.  $P(X = 8, 9 \text{ of } 10) = \text{binomcdf}(25, 0.42, 10) - \text{binomcdf}(25, 0.42, 7) = 0,394$

### Opgave 52:

- a.  $P(X \geq 4) = 1 - P(X \leq 3) = 1 - \text{binomcdf}(50, 0.13, 3) = 0,904$
- b.  $P(X > 4) = 1 - P(X \leq 4) = 1 - \text{binomcdf}(50, 0.13, 4) = 0,796$
- c.  $P(X = 5 \vee X = 6) = \text{binompdf}(50, 0.13, 5) + \text{binompdf}(50, 0.13, 6) = 0,317$
- d.  $P(7 < X < 14) = P(X \leq 13) - P(X \leq 7)$   
 $= \text{binomcdf}(50, 0.13, 13) - \text{binomcdf}(50, 0.13, 7) = 0,318$

### Opgave 53:

- a.  $P(X \geq 5) = 1 - P(X \leq 4) = 1 - \text{binomcdf}(10, 0.5, 4) = 0,623$
- b.  $P(10 < X < 20) = P(X \leq 19) - P(X \leq 10)$

$$= \text{binomcdf}(25,0.5,19) - \text{binomcdf}(25,0.5,10) = 0,786$$

- c.  $P(Y > 40) = 1 - P(Y \leq 40) = 1 - \text{binomcdf}(100, \frac{1}{3}, 40) = 0,066$   
d.  $P(Z = 7) = \text{binompdf}(35, \frac{1}{6}, 7) = 0,146$   
e.  $P(Z = 0) = \text{binompdf}(10, \frac{1}{6}, 0) = 0,162$

**Opgave 54:**

- a.  $P(X > 10) = 1 - P(X \leq 10) = 1 - \text{binomcdf}(16,0.5,10) = 0,105$   
b.  $P(Y < 2) = P(Y \leq 1) = \text{binomcdf}(16, \frac{1}{6}, 1) = 0,227$   
c.  $P(Z = 5) = \text{binompdf}(16, \frac{1}{6}, 5) = 0,076$

**Opgave 55:**

$$P(X \geq 7) = 1 - P(X \leq 6) = 1 - \text{binomcdf}(9,0.9,6) = 0,947$$

**Opgave 56:**

a.  $P(2r) = \frac{\binom{12}{2}}{\binom{25}{2}} = 0,22$

$$P(X = 3) = \text{binompdf}(15,0.22,3) = 0,246$$

b.  $P(1z) = \frac{\binom{8}{1} \binom{17}{1}}{\binom{25}{2}} = 0,453$

$$P(Y \geq 10) = 1 - P(Y \leq 9) = 1 - \text{binomcdf}(15,0.543,9) = 0,081$$

c.  $P(2 \text{ knikkers van dezelfde kleur}) = \frac{\binom{12}{2} + \binom{8}{2} + \binom{5}{2}}{\binom{25}{2}} = 0,347$

$$P(Z < 6) = P(Z \leq 5) = \text{binomcdf}(15,0.347,5) = 0,575$$

d.  $P(\text{minstens 1 rood}) = 1 - P(\text{geen rood}) = 1 - \frac{\binom{13}{2}}{\binom{25}{2}} = 0,74$

$$P(A \geq 8) = 1 - P(A \leq 7) = 1 - \text{binomcdf}(15,0.74,7) = 0,978$$

**Opgave 57:**

a.  $P(X > 72) = 1 - P(X \leq 72) = 1 - \text{binomcdf}(120, \frac{2}{3}, 72) = 0,925$

b.  $P(Y \geq 3) = 1 - P(Y \leq 2) = 1 - \text{binomcdf}(6,0.4,2) = 0,456$

**Opgave 58:**

a.  $P(X \geq 20) = 1 - P(X \leq 19) = 1 - \text{binomcdf}(80,0.22,19) = 0,298$

b.  $P(16 < Y < 24) = P(Y \leq 23) - P(Y \leq 16)$   
 $= \text{binomcdf}(80,0.36,23) - \text{binomcdf}(80,0.36,16) = 0,106$

c.  $P(16 < Z < 24) = P(Z \leq 23) - P(Z \leq 16)$   
 $= \text{binomcdf}(80,0.28,23) - \text{binomcdf}(80,0.28,16) = 0,0547$

d.  $0,22^2 \cdot 0,36^4 \cdot 0,28^4 \cdot \frac{10!}{2! \cdot 4! \cdot 4!} = 0,016$

**Opgave 59:**

- a.  $P(10 < X < 15) = P(X \leq 14) - P(X \leq 10)$   
 $= \text{binomcdf}(25,0.5,14) - \text{binomcdf}(25,0.5,10) = 0,576$
- b.  $P(2 \times \text{munt}) = 0,25$   
 $P(Y \leq 5) = \text{binomcdf}(30,0.25,5) = 0,203$
- c.  $P(Z \leq 10) = \text{binomcdf}(15, \frac{1}{3}, 10) = 0,998$
- d.  $P(\text{meer dan 7 ogen}) = \frac{15}{36}$   
 $P(A = 5) = \text{binompdf}(18, \frac{15}{36}, 5) = 0,097$

**Opgave 60:**

$$P(X \leq 92) = \text{binomcdf}(100,0.88,92) = 0,924$$

**Opgave 61:**

- a.  $P(X \geq 1) = 1 - P(X = 0) = 1 - \text{binompdf}(10,0.0.25,0) = 0,224$
- b.  $P(Y \geq 38) = 1 - P(Y \leq 37) = 1 - \text{binomcdf}(40,0.975,37) = 0,922$
- c.  $P(X \geq 1) = 1 - P(X = 0) = 1 - \text{binompdf}(10,0.0.01,0) = 0,096$

**Opgave 62:**

- a.  $P(X \geq 5) = 1 - P(X \leq 4) = 1 - \text{binomcdf}(n,0.5,4) > 0,99$   
 $y_1 = 1 - \text{binomcdf}(X,0.5,4)$  kijk in de tabel voor welke  $X$  geldt dat  $y_1 > 0,99$   
dat is voor  $X = 19$ , dus minstens 19 keer gooien
- b.  $P(\text{minsten 1 keer munt}) = 0,75$   
 $P(Y \geq 2) = 1 - P(Y \leq 1) = 1 - \text{binomcdf}(n,0.75,1) > 0,98$   
 $y_1 = 1 - \text{binomcdf}(X,0.75,1)$  kijk in de tabel voor welke  $X$  geldt dat  $y_1 > 0,98$   
dat is voor  $X = 5$ , dus minstens 5 keer gooien

**Opgave 63:**

$$P(X \geq 5) = 1 - P(X \leq 4) = 1 - \text{binomcdf}(n,0.4,4) > 0,90$$

$$y_1 = 1 - \text{binomcdf}(X,0.4,4)$$
 kijk in de tabel voor welke  $X$  geldt dat  $y_1 > 0,90$   
dat is voor  $X = 18$ , dus minstens 18 keer gooien

**Opgave 64:**

$$P(2 \text{ wit}) = \frac{\binom{6}{2}}{\binom{10}{2}} = \frac{1}{3}$$

$$P(X \geq 3) = 1 - P(X \leq 2) = 1 - \text{binomcdf}(n, \frac{1}{3}, 2) > 0,95$$

$$y_1 = 1 - \text{binomcdf}(X, \frac{1}{3}, 2)$$
 kijk in de tabel voor welke  $X$  geldt dat  $y_1 > 0,95$   
dat is voor  $X = 17$ , dus minstens 17 keer

**Opgave 65:**

- a.  $\text{normalcdf}(13,19,15,2.8) = 0,686$
- b.  $\text{normalcdf}(-10^{99}, 20.4, 15, 2.8) = 0,973$
- c.  $\text{normalcdf}(21.3, 10^{99}, 15, 2.8) = 0,012$

**Opgave 66:**

- a.  $normalcdf(80,10^{99},75,18) = 0,391$   
b.  $0,391^5 = 0,009$

**Opgave 67:**

- a.  $P(\text{inhoud} < 125) = normalcdf(-10^{99},125,130,5) = 0,159$   
 $P(X \leq 4) = binomcdf(50,0.159,4) = 0,085$   
b.  $P(\text{inhoud} < 128) = normalcdf(-10^{99},128,130,5) = 0,345$   
 $P(X \geq 8) = 1 - P(X \leq 7) = 1 - binomcdf(50,0.345,7) = 0,999$   
c.  $P(\text{inhoud} > 132) = normalcdf(132,10^{99},130,5) = 0,345$   
 $P(X = 8) = binompdf(50,0.345,8) = 0,002$

**Opgave 68:**

- a.  $P(d < 14,15) = normalcdf(-10^{99},14.15,14.31,0.12) = 0,091$   
 $P(X \leq 5) = binomcdf(100,0.091,5) = 0,097$   
b.  $P(d > 14,50) = normalcdf(14.50,10^{99},14.31,0.12) = 0,057$   
 $P(X \geq 10) = 1 - P(X \leq 9) = 1 - binomcdf(100,0.57,9) = 0,057$

**Opgave 69:**

- a.  $P(\text{show} > 120) = normalcdf(120,10^{99},112,5) = 0,055$   
 $P(X \geq 4) = 1 - P(X \leq 3) = 1 - binomcdf(22,0.055,3) = 0,030$   
b.  $P(\text{show} < 105) = normalcdf(-10^{99},105,112,5) = 0,081$   
 $120 \cdot 0,081 = 9,7$  dus 10 shows