1ab $P(\text{rood uit I}) = \dfrac{\text{aantal gunstige uitkomsten}}{\text{aantal mogelijke uitkomsten}}$ (kansdefinitie van Laplace) $= \frac{3}{4}$ en $P(\text{rood uit II}) = \frac{2}{3}$.

1c Er zijn 12 mogelijke uitkomsten, waarvan 6 keer "r r".

1d $P(\text{r r}) = \frac{6}{12} = 0{,}5$.

1e $P(\text{rood uit I}) \cdot P(\text{rood uit II}) = \frac{3}{4} \cdot \frac{2}{3} = \frac{6}{12} = \frac{1}{2}$. Dus het klopt.

```
6/12▸Frac
                1/2
3/4*2/3▸Frac
                1/2
```

2a $P(\text{w w}) = \frac{5}{10} \cdot \frac{2}{5} = \frac{1}{5}$.

2b $P(\underline{\underline{\text{b r}}}) = P(\text{r b}) = \frac{2}{10} \cdot \frac{2}{5} = \frac{2}{25}$.

2c $P(\underline{\underline{\text{w g}}}) = P(\text{w g}) = \frac{5}{10} \cdot \frac{1}{5} = \frac{1}{10}$.

```
5/10*2/5▸Frac
                1/5
2/10*2/5▸Frac
               2/25
5/10*1/5▸Frac
               1/10
```

2d $P(\bar{\text{b}}\,\bar{\text{b}}) = \frac{7}{10} \cdot \frac{3}{5} = \frac{21}{50}$.

2e $P(\bar{\text{r}}\,\bar{\text{r}}) = \frac{8}{10} \cdot \frac{5}{5} = \frac{4}{5}$.

```
7/10*3/5▸Frac
              21/50
8/10*5/5▸Frac
                4/5
```

($\bar{\text{b}}$ betekent "niet b")

(dubbel onderstreept betekent "niet alleen" in de genoteerde volgorde)

3a $P(\text{b b b}) = \frac{2}{4} \cdot \frac{1}{3} \cdot \frac{1}{2} = \frac{1}{12}$.

3b $P(\bar{\text{k}}\,\bar{\text{k}}\,\bar{\text{k}}) = \frac{3}{4} \cdot \frac{2}{3} \cdot \frac{1}{2} = \frac{1}{4}$.

```
2/4*1/3*1/2▸Frac
               1/12
3/4*2/3*1/2▸Frac
                1/4
```

3c $P(\underline{\underline{\text{c c b}}}) = P(\text{c c b}) = \frac{1}{4} \cdot \frac{1}{3} \cdot \frac{1}{2} = \frac{1}{24}$.

3d $P(\text{c c c}) = \ldots \cdot \ldots \cdot 0 = 0$.

```
1/4*1/3*1/2▸Frac
               1/24
```

4a $P(<5\ <5\ <5) = \frac{4}{6} \cdot \frac{4}{6} \cdot \frac{4}{6} = \frac{8}{27}$.

4b $P(\bar{5}\,\bar{5}\,\bar{5}) = \frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6} = \frac{125}{216}$.

4c $P(>4\ >4\ >4) = \frac{2}{6} \cdot \frac{2}{6} \cdot \frac{2}{6} = \frac{1}{27}$.

```
(4/6)^3▸Frac
               8/27
(5/6)^3▸Frac
            125/216
(2/6)^3▸Frac
               1/27
```

5a $P(\bar{4}\,\bar{4}\,\bar{4}\,\bar{4}) = \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \approx 0{,}316$.

5b $P(<3\ <3\ <3\ <3) = \frac{2}{4} \cdot \frac{2}{4} \cdot \frac{2}{4} \cdot \frac{2}{4} \approx 0{,}063$.

5c $P(\text{som} = 4) = P(1\,1\,1\,1) = \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} \approx 0{,}004$.

```
(3/4)^4
         .31640625
(2/4)^4
             .0625
(1/4)^4
        .00390625
```

6a Dit is een empirische kans.

6b $P(\text{so vl ijs}) = 0{,}6 \cdot 0{,}5 \cdot 0{,}8 = 0{,}24$.

```
0.6*0.5*0.8
                .24
```

6c $P(\text{sa ve ba}) = 0{,}4 \cdot 0{,}2 \cdot 0{,}2 = 0{,}016$.

6d $P(\text{so vi ijs}) = 0{,}6 \cdot 0{,}3 \cdot 0{,}8 = 0{,}144$.
Je verwacht $0{,}144 \times 500 = 72$ gasten.

```
0.4*0.2*0.2
               .016
0.6*0.3*0.8
               .144
Ans*500
                 72
```

7a Afhankelijk, want de kinderen komen uit hetzelfde gezin.

7b Onafhankelijk, de plaatsen Breda en Sydney liggen heel ver van elkaar af.
$P(\text{regen in Breda en Sydney}) = 0{,}7 \cdot 0{,}2 = 0{,}14$.

7c Afhankelijk, de plaatsen liggen vrij dicht bij elkaar.

7d Afhankelijk, een meisje met oorbellen heeft vaker een ketting om dan een meisje zonder oorbellen.

8a $P(\text{r r}) = \frac{2}{4} \cdot \frac{1}{3} = \frac{1}{6}$.

8b $P(\text{w w}) = \frac{1}{4} \cdot \frac{1}{3} = \frac{1}{12}$.

8c $P(\text{twee sectoren met dezelfde kleur}) = P(\text{r r}) + P(\text{w w})$.

9a $P(3\,3) = \frac{2}{4} \cdot \frac{1}{3} \approx 0{,}167$.

9b $P(\bar{2}\,\bar{2}) = \frac{3}{4} \cdot \frac{2}{3} = 0{,}5$.

9c $P(\underline{\underline{3\,\bar{3}}}) = P(3\,\bar{3}) + P(\bar{3}\,3) = \frac{2}{4} \cdot \frac{2}{3} + \frac{2}{4} \cdot \frac{1}{3} = 0{,}5$.

```
2/4*1/3
        .1666666667
3/4*2/3
                 .5
2/4*2/3+2/4*1/3
                 .5
```

9d $P(\text{som} = 4) = P(2\,2) + P(\underline{\underline{1\,3}}) = P(2\,2) + P(3\,1) = \frac{1}{4} \cdot \frac{1}{3} + \frac{2}{4} \cdot \frac{1}{3} = 0{,}25$.

9e $P(\text{minstens één 3}) = 1 - P(\bar{3}\,\bar{3}) = 1 - \frac{2}{4} \cdot \frac{2}{3} \approx 0{,}667$.

```
1/4*1/3+2/4*1/3
                .25
1-2/4*2/3
        .6666666667
```

10a $P(\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}) = \frac{2}{4} \cdot \frac{2}{3} \cdot \frac{3}{5} = 0{,}2$.

10b $P(\text{drie dezelfde vruchten}) = P(\text{b b b}) + P(\text{k k k}) + P(\text{c c c}) = \frac{2}{4} \cdot \frac{1}{3} \cdot \frac{2}{5} + \frac{1}{4} \cdot \frac{1}{3} \cdot \frac{1}{5} + \frac{1}{4} \cdot \frac{1}{3} \cdot \frac{2}{5} \approx 0{,}117$.

10c $P(\underline{\underline{\text{c}\,\bar{\text{c}}\,\bar{\text{c}}}}) = P(\text{c}\,\bar{\text{c}}\,\bar{\text{c}}) + P(\bar{\text{c}}\,\text{c}\,\bar{\text{c}}) + P(\bar{\text{c}}\,\bar{\text{c}}\,\text{c}) = \frac{1}{4} \cdot \frac{2}{3} \cdot \frac{3}{5} + \frac{3}{4} \cdot \frac{1}{3} \cdot \frac{3}{5} + \frac{3}{4} \cdot \frac{2}{3} \cdot \frac{2}{5} = 0{,}45$.

10d $P(\text{minstens één kers}) = 1 - P(\bar{\text{k}}\,\bar{\text{k}}\,\bar{\text{k}}) = 1 - \frac{3}{4} \cdot \frac{2}{3} \cdot \frac{4}{5} = 0{,}6$.

```
2/4*2/3*3/5
                 .2
2/4*1/3*2/5+1/4*
1/3*1/5+1/4*1/3*
2/5
        .1166666667
```

```
1/4*2/3*3/5+3/4*
1/3*3/5+3/4*2/3*
2/5
                .45
1-3/4*2/3*4/5
                 .6
```

11a $P(\underline{\underline{\text{w w b}}}) = P(\text{w w b}) + P(\text{w b w}) + P(\text{b w w}) = \frac{2}{5} \cdot \frac{2}{6} \cdot \frac{3}{4} + \frac{2}{5} \cdot \frac{4}{6} \cdot \frac{1}{4} + \frac{3}{5} \cdot \frac{2}{6} \cdot \frac{1}{4} \approx 0{,}217$.

11b $P(\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}) = P(\text{w w w}) = \frac{2}{5} \cdot \frac{2}{6} \cdot \frac{1}{4} \approx 0{,}033$.

11c $P(\text{minstens één witte}) = 1 - P(\text{geen witte}) = 1 - P(\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}) = 1 - \frac{3}{5} \cdot \frac{4}{6} \cdot \frac{3}{4} = 0{,}7$.

```
5*6*4
                120
(2*2*3+2*4*1+3*2
*1)/120
        .2166666667
```

```
2*2*1/120
        .0333333333
1-3*4*3/120
                 .7
```

11d $P(\text{hoogstens één witte}) = P(\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}) + P(\underline{\underline{\text{w}\,\bar{\text{w}}\,\bar{\text{w}}}})$
$= P(\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}) + P(\text{w}\,\bar{\text{w}}\,\bar{\text{w}}) + P(\bar{\text{w}}\,\text{w}\,\bar{\text{w}}) + P(\bar{\text{w}}\,\bar{\text{w}}\,\text{w}) = \frac{3}{5} \cdot \frac{4}{6} \cdot \frac{3}{4} + \frac{2}{5} \cdot \frac{4}{6} \cdot \frac{3}{4} + \frac{3}{5} \cdot \frac{2}{6} \cdot \frac{3}{4} + \frac{3}{5} \cdot \frac{4}{6} \cdot \frac{1}{4} = 0{,}75$.

```
3*4*3+2*4*3+3*2*
3+3*4*1
                 90
Ans/120
                .75
```

12a $P(\text{p p p}) = \frac{3}{8} \cdot \frac{1}{8} \cdot \frac{2}{8} \approx 0{,}012$.

12b $P(\underline{\underline{\text{c c k}}}) = P(\text{c c k}) + P(\text{c k c}) + P(\text{k c c}) = \frac{2}{8} \cdot \frac{6}{8} \cdot \frac{2}{8} + \frac{2}{8} \cdot \frac{1}{8} \cdot \frac{3}{8} + \frac{2}{8} \cdot \frac{6}{8} \cdot \frac{3}{8} \approx 0{,}129$.

```
3*2*1/8^3
          .01171875
(2*6*2+2*1*3+2*6
*3)/8^3
          .12890625
```

12c $P(\bar{a}\,\bar{a}\,\bar{a}) = \frac{7}{8} \cdot \frac{8}{8} \cdot \frac{7}{8} \approx 0{,}766.$

12d $P(\underline{\underline{a\,\bar{a}\,\bar{a}}}) = P(a\,\bar{a}\,\bar{a}) + P(\bar{a}\,a\,\bar{a}) + P(\bar{a}\,\bar{a}\,a) = \frac{1}{8} \cdot \frac{8}{8} \cdot \frac{7}{8} + 0 + \frac{7}{8} \cdot \frac{8}{8} \cdot \frac{1}{8} \approx 0{,}219.$

12e $P(p \geq 1) = 1 - P(p < 1) = 1 - P(p = 0) = 1 - P(\bar{p}\,\bar{p}\,\bar{p}) = 1 - \frac{5}{8} \cdot \frac{7}{8} \cdot \frac{6}{8} \approx 0{,}590.$

```
7*8*7/8^3
              .765625
(1*8*7+0+7*8*1)/
8^3
               .21875
1-5*7*6/8^3
           .58984375
```

13 $P(A \text{ functioneert}) = P(A) = 1 - 0{,}001 = 0{,}999.$
$P(A\ B\ C\ D\ E) = 0{,}999 \cdot 0{,}997 \cdot 0{,}998 \cdot 0{,}992 \cdot 0{,}975 \approx 0{,}961.$

```
0.999*0.997*0.99
8*0.992*0.975
         .9614074334
```

14a $P(d\,d\,d) = 0{,}6 \cdot 0{,}3 \cdot 0{,}8 = 0{,}144.$

14b $P(\underline{\underline{w\,d}}\,d) = P(w\,d\,d) + P(d\,w\,d) = 0{,}4 \cdot 0{,}3 \cdot 0{,}8 + 0{,}6 \cdot 0{,}7 \cdot 0{,}8 = 0{,}432.$

```
0.6*0.3*0.8
                 .144
0.4*0.3*0.8+0.6*
0.7*0.8
                 .432
```

15a $P(\text{tweejarige wordt 4}) = 0{,}40 \cdot 0{,}25 = 0{,}1.$

15b $P(\text{pasgeboren muis wordt 3 maar geen 4}) = 0{,}42 \cdot 0{,}60 \cdot 0{,}40 \cdot 0{,}75 \approx 0{,}076.$

15c $P(\text{pasgeboren muis wordt geen 3}) = 1 - P(\text{pasgeboren muis wordt 3}) = 1 - 0{,}42 \cdot 0{,}60 \cdot 0{,}40 \approx 0{,}899.$

```
0.4*0.25
                   .1
0.42*0.6*0.4*0.7
5
                .0756
1-0.42*0.6*0.4
                .8992
```

16a $P(\text{geen enkele keer 6}) = P(\bar{6}\,\bar{6}\,\bar{6}\,\bar{6}) = \frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6} \approx 0{,}482.$

```
(5/6)^4
         .4822530864
```

16b $P(\text{geen enkele 6}) = P(\bar{6}\,\bar{6}\,\bar{6}\,\bar{6}) \approx 0{,}482.$

17a $P(\underline{\underline{a\,a\,a\,p\,p\,p}}) = \binom{6}{3} \cdot P(a\,a\,a\,p\,p\,p) = \binom{6}{3} \cdot (\frac{2}{5})^3 \cdot (\frac{2}{5})^3 \approx 0{,}082.$

17b $P(a \geq 1) = 1 - P(a < 1) = 1 - P(a = 0) = 1 - P(\bar{a}\,\bar{a}\,\bar{a}\,\bar{a}\,\bar{a}\,\bar{a}) = 1 - (\frac{3}{5})^6 \approx 0{,}953.$

17c $P(b = 3) = P(\underline{\underline{b\,b\,b\,\bar{b}\,\bar{b}\,\bar{b}}}) = \binom{6}{3} \cdot P(b\,b\,b\,\bar{b}\,\bar{b}\,\bar{b}) = \binom{6}{3} \cdot (\frac{1}{5})^3 \cdot (\frac{4}{5})^3 \approx 0{,}082.$

```
6 nCr 3*(2/5)^3*
(2/5)^3
               .08192
1-(3/5)^6
              .953344
```

```
6 nCr 3*(1/5)^3*
(4/5)^3
               .08192
```

18a $P(\underline{\underline{a\,b}}) = \binom{2}{1} \cdot P(a\,b) = \binom{2}{1} \cdot \frac{2}{5} \cdot \frac{1}{5} = 0{,}16.$

```
2 nCr 1*2/5*1/5
                  .16
```

18b $P(\bar{b}\,\bar{b}) = (\frac{4}{5})^2 = 0{,}64.$

18c $P(\text{twee verschillende vruchten}) = P(\underline{\underline{a\,b}}) + P(\underline{\underline{a\,p}}) + P(\underline{\underline{b\,p}}) = \binom{2}{1} \cdot \frac{2}{5} \cdot \frac{1}{5} + \binom{2}{1} \cdot \frac{2}{5} \cdot \frac{2}{5} + \binom{2}{1} \cdot \frac{1}{5} \cdot \frac{2}{5} = 0{,}64.$

```
(4/5)^2
                  .64
2 nCr 1*2/5*1/5+
2 nCr 1*2/5*2/5+
2 nCr 1*1/5*2/5
                  .64
```

19a $P(\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}) = (\frac{3}{4})^6 \approx 0{,}178.$

```
(3/4)^6
         .1779785156
```

19b $P(\underline{\underline{g\,g\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}}}) = \binom{6}{2} \cdot (\frac{1}{4})^2 \cdot (\frac{3}{4})^4 \approx 0{,}297.$

19c $P(\mathit{goed} \geq 2) = 1 - P(\mathit{goed} \leq 1) = 1 - P(\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}) - P(\underline{\underline{g\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}}}) = 1 - (\frac{3}{4})^6 - \binom{6}{1} \cdot (\frac{1}{4})^1 \cdot (\frac{3}{4})^5 \approx 0{,}466.$

```
6 nCr 2*(1/4)^2*
(3/4)^4
         .2966308594
1-(3/4)^6-6 nCr
1*(1/4)*(3/4)^5
         .4660644531
```

20a $P(\text{lukt}) = P(l) = 0{,}28 \Rightarrow P(\text{mislukt}) = P(m) = 1 - 0{,}28 = 0{,}72 \Rightarrow P(m\,m\,m) = 0{,}72^3 \approx 0{,}373.$

20b $P(\text{minstens één keer lukt}) = 1 - P(\text{geen keer lukt}) = 1 - P(m\,m\,m\,m\,m) = 1 - 0{,}72^5 \approx 0{,}807.$

```
0.72^3
              .373248
1-0.72^5
         .8065082368
```

20c $P(\text{minstens één keer lukt bij } n \text{ proeven}) = 1 - P(\text{geen keer lukt bij } n \text{ proeven}) = 1 - 0{,}72^n > 0{,}95.$
$1 - 0{,}72^n = 0{,}95$ (intersect en zie plot of zie TABLE) $\Rightarrow n \geq 10.$ Dus minstens 10 keer uitvoeren.

```
Plot1 Plot2 Plot3
\Y1=1-0.72^X
\Y2=0.95
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

X	Y1	Y2
6	.86069	.95
7	.89969	.95
8	.92778	.95
9	.948	.95
10	.96256	.95
11	.97304	.95
12	.98059	.95

Y1=.962560937574

21a $P(\underline{\underline{j\,j\,j\,o\,o\,o\,o\,o\,o\,o}}) = \binom{10}{3} \cdot 0{,}4^3 \cdot 0{,}6^7 \approx 0{,}215.$

```
10 nCr 3*0.4^3*0
.6^7
          .214990848
```

21b $P(\mathit{juist} \geq 2) = 1 - P(\mathit{juist} \leq 1) = 1 - P(o\,o\,o\,o\,o\,o\,o\,o\,o\,o) - P(\underline{\underline{j\,o\,o\,o\,o\,o\,o\,o\,o\,o}}) = 1 - 0{,}6^{10} - \binom{10}{1} \cdot 0{,}4 \cdot 0{,}6^9 \approx 0{,}954.$

```
1-0.6^10-10 nCr
1*0.4*0.6^9
         .9536425984
```

22a $P(\bar{2}\,\bar{2}\,\bar{2}\,\bar{2}\,\bar{2}) = (\frac{3}{4})^5 \approx 0{,}237.$

22b $P(\underline{\underline{2\,2\,2\,\bar{2}\,\bar{2}}}) = \binom{5}{3} \cdot (\frac{1}{4})^3 \cdot (\frac{3}{4})^2 \approx 0{,}088.$

```
(3/4)^5
        .2373046875
5 nCr 3*(1/4)^3*
(3/4)^2
         .087890625
```

22c $P(\underline{\underline{2\,2\,2\,1\,1}}) = \binom{5}{3} \cdot (\frac{1}{4})^3 \cdot (\frac{1}{4})^2 \approx 0{,}010.$

22d $P(\text{minstens twee keer 1}) = 1 - P(\text{geen 1}) - P(\text{één 1}) = 1 - P(\bar{1}\,\bar{1}\,\bar{1}\,\bar{1}\,\bar{1}) - P(\underline{\underline{1\,\bar{1}\,\bar{1}\,\bar{1}\,\bar{1}}}) = 1 - (\frac{3}{4})^5 - \binom{5}{1} \cdot \frac{1}{4} \cdot (\frac{3}{4})^4 \approx 0{,}367.$

```
5 nCr 3*(1/4)^3*
(1/4)^2
         .009765625
1-(3/4)^5-5 nCr
1*1/4*(3/4)^4
          .3671875
```

23a $P(\underline{\underline{4\,4\,4\,\bar{4}\,\bar{4}\,\bar{4}}}) = \binom{6}{3} \cdot (\frac{1}{6})^3 \cdot (\frac{5}{6})^3 \approx 0{,}054.$

23b $P(\text{minstens één 6}) = 1 - P(\text{geen 6}) = 1 - P(\bar{6}\,\bar{6}\,\bar{6}\,\bar{6}\,\bar{6}\,\bar{6}) = 1 - (\frac{5}{6})^6 \approx 0{,}665.$

```
6 nCr 3*(1/6)^3*
(5/6)^3
         .0535836763
1-(5/6)^6
         .6651020233
```

23c $P(\text{zes verschillende aantallen ogen}) = P(\underline{\underline{1\,2\,3\,4\,5\,6}}) = 6! \cdot P(1\,2\,3\,4\,5\,6) = 6! \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} = 6! \cdot (\frac{1}{6})^6 \approx 0{,}015.$

23d $P(\text{twee keer 6 en geen 5}) = P(\underline{\underline{6\,6\,\overline{5 \text{ of } 6}\,\overline{5 \text{ of } 6}\,\overline{5 \text{ of } 6}\,\overline{5 \text{ of } 6}}}) = \binom{6}{2} \cdot (\frac{1}{6})^2 \cdot (\frac{4}{6})^4 \approx 0{,}082.$

```
6!*(1/6)^6
         .0154320988
6 nCr 2*(1/6)^2*
(4/6)^4
         .0823045267
```

24a $P(som = 6) = P(6) = \frac{5}{36}$ (zie het rooster hiernaast).

24b $P(\underline{\underline{6\,6\,6\,6\,\bar{6}\,\bar{6}\,\bar{6}\,\bar{6}}}) = \binom{8}{4} \cdot (\frac{5}{36})^4 \cdot (\frac{31}{36})^4 \approx 0{,}014.$

24c $P(som < 5) = P({<}5) = \frac{6}{36} = \frac{1}{6}$ (zie het rooster hiernaast).

$P(\underline{\underline{{<}5\,{<}5\,{<}5\,\overline{{<}5}\,\overline{{<}5}\,\overline{{<}5}\,\overline{{<}5}\,\overline{{<}5}}}) = \binom{8}{3} \cdot (\frac{1}{6})^3 \cdot (\frac{5}{6})^5 \approx 0{,}104.$

```
8 nCr 4*(5/36)^4
*(31/36)^4
      .0143220382
8 nCr 3*(1/6)^3*
(5/6)^5
      .1041904816
```

```
Plot1 Plot2 Plot3
\Y1=1-(35/36)^X
\Y2=0.75
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

X	Y1	Y2
46	.72634	.75
47	.73394	.75
48	.74133	.75
49	.74852	.75
50	.7555	.75
51	.76229	.75
52	.7689	.75

X=52

6	7	8	9	10	11	12
5	6	7	8	9	10	11
4	5	6	7	8	9	10
3	4	5	6	7	8	9
2	3	4	5	6	7	8
1	2	3	4	5	6	7
+	**1**	**2**	**3**	**4**	**5**	**6**

24d $P(som = 12) = P(12) = \frac{1}{36}$ (zie het rooster). $P(\text{minstens één keer } 12) = 1 - P(\overline{12}\ \overline{12}\ \overline{12}\ \overline{12}\ \overline{12} \ldots \overline{12}\ \overline{12}\ \overline{12}\ \overline{12}) = 1 - (\frac{35}{36})^n > 0{,}75.$
Bladeren in de tabel geeft $n \geq 50$. Dus Martijn moet minstens 50 keer met twee dobbelstenen gooien.

25a $P(\text{minstens één keer } 6) = 1 - P(\text{geen } 6) = 1 - P(\bar{6}\,\bar{6}\,\bar{6}\,\bar{6}) = 1 - (\frac{5}{6})^4 \approx 0{,}518.$

```
1-(5/6)^4
      .5177469136
```

De berekening van de Meré klopt dus niet. (met 7 dobbelstenen gooien zou een kans geven die groter is dan 1 en dat kan niet)
Het is wél voordeliger om te wedden op minstens één 6.

25b $P(dubbel\ 6) = P(som = 12) = \frac{1}{36}$ (zie het rooster hierboven).

$P(dubbel\ 6 \geq 1) = 1 - P(dubbel\ 6 < 1) = 1 - P(dubbel\ 6 = 0) = 1 - P(\overline{12}\ \overline{12}\ \overline{12}\ \overline{12} \ldots \overline{12}\ \overline{12}\ \overline{12}) = 1 - (\frac{35}{36})^{24} \approx 0{,}491.$

```
1-(35/36)^24
      .4914038761
1-Ans
      .5085961239
```

De berekening van de Meré klopt weer niet. Het wedden op minstens één keer dubbel zes is zelfs nadeliger, want het wedden op geen enkele keer dubbel zes is $P(\text{dubbel } 6 = 0) \approx 1 - 0{,}491 = 0{,}509.$

26a $P(\text{z z z z}) = (\frac{18}{38})^4 \approx 0{,}050.$ 26b $P(\underline{\underline{\text{z z r r}}}) = \binom{4}{2} \cdot P(\text{z z r r}) = \binom{4}{2} \cdot (\frac{18}{38})^2 \cdot (\frac{18}{38})^2 \approx 0{,}302.$

```
(18/38)^4
      .0503449175
4 nCr 2*(18/38)^
4
      .3020695053
```

26c $P(wit \geq 1) = 1 - P(wit < 1) = 1 - P(wit = 0) = 1 - P(\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}) = 1 - (\frac{36}{38})^4 \approx 0{,}194.$

26d $P(uitkering = € 40) = P(rood = 2) = P(\underline{\underline{\text{r r }\bar{\text{r}}\,\bar{\text{r}}}}) = \binom{4}{2} \cdot P(\text{r r }\bar{\text{r}}\,\bar{\text{r}}) = \binom{4}{2} \cdot (\frac{18}{38})^2 \cdot (\frac{20}{38})^2 \approx 0{,}373.$

```
1-(36/38)^4
      .1944813192
4 nCr 2*(18/38)²
*(20/38)²
      .3729253152
```

26e $P(uitkering > € 50) = P(uitkering \geq € 60) = P(rood \geq 3) = P(\underline{\underline{\text{r r r }\bar{\text{r}}\,\bar{\text{r}}}}) + P(\underline{\underline{\text{r r r r }\bar{\text{r}}}}) + P(\text{r r r r r})$

$= \binom{5}{3} \cdot (\frac{18}{38})^3 \cdot (\frac{20}{38})^2 + \binom{5}{4} \cdot (\frac{18}{38})^4 \cdot \frac{20}{38} + (\frac{18}{38})^5 \approx 0{,}451.$

```
5 nCr 3*18^3*20²
+5 nCr 4*18^4*20
+18^5
         35715168
Ans/38^5
      .4507489402
```

27a $P(\text{vijf weken geen foto}) = P(\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}) = (\frac{4}{5})^5 \approx 0{,}328.$

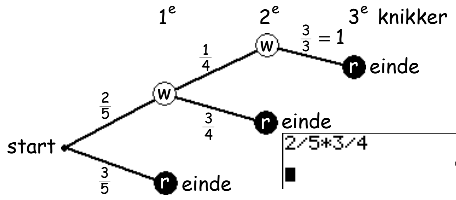
27b $P(\text{in zes weken minstens één foto}) = 1 - P(\text{in zes weken minstens geen foto}) = 1 - P(\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}) = 1 - (\frac{4}{5})^6 \approx 0{,}738.$

27c $P(\text{in acht weken precies twee foto's}) = P(\underline{\underline{\text{f f }\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}}}) = \binom{8}{2} \cdot P(\text{f f }\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}\,\bar{\text{f}}) = \binom{8}{2} \cdot (\frac{1}{5})^2 \cdot (\frac{4}{5})^6 \approx 0{,}294.$

```
(4/5)^5
           .32768
1-(4/5)^6
          .737856
8 nCr 2*(1/5)²*(
4/5)^6
        .29360128
```

28a Na de eerste keer een witte knikker gepakt te hebben, bevinden zich nog 3 rode en 1 witte knikker in de vaas. De kans op een witte is dan dus $\frac{1}{4}$.

28b Zie de kansboom hiernaast.



28c $P(\text{twee knikkers}) = P(\text{eerst wit en dan pas rood}) = P(\text{w r}) = \frac{2}{5} \cdot \frac{3}{4} = 0{,}3.$

```
2/5*3/4
               .3
```

29a $P(\text{twee knikkers}) = P(\bar{\text{w}}\text{ w}) = \frac{5}{8} \cdot \frac{3}{7} \approx 0{,}268.$ 29b $P(\text{vier knikkers}) = P(\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}\text{ w}) = \frac{5}{8} \cdot \frac{4}{7} \cdot \frac{3}{6} \cdot \frac{3}{5} \approx 0{,}107.$

```
5*3/8/7
      .2678571429
5*4*3*3/8/7/6/5
      .1071428571
```

30a $P(\text{vierde dvd is de eerste van mindere kwaliteit}) = P(\text{g g g m}) = \frac{8}{10} \cdot \frac{7}{9} \cdot \frac{6}{8} \cdot \frac{2}{7} \approx 0{,}133.$

30b $P(\text{zesde dvd is de eerste van mindere kwaliteit}) = P(\text{g g g g g m}) = \frac{8}{10} \cdot \frac{7}{9} \cdot \frac{6}{8} \cdot \frac{5}{7} \cdot \frac{4}{6} \cdot \frac{2}{5} \approx 0{,}089.$

```
8*7*6*2/10/9/8/7
      .1333333333
8*7*6*5*4*2/10/9
/8/7/6/5
      .0888888889
```

30c $P(\text{vijfde al de tweede van mindere kwaliteit}) = P(\underline{\underline{\text{g g g m}}}\text{ m}) = P(\underline{\underline{\text{g g g m}}}) \cdot P(\text{m}) = \binom{4}{3} \cdot \frac{8}{10} \cdot \frac{7}{9} \cdot \frac{6}{8} \cdot \frac{2}{7} \cdot \frac{1}{6} \approx 0{,}089.$

```
4 nCr 3*8*7*6*2/
10/9/8/7/6
      .0888888889
```

31a $P(\text{Lotte wint in twee sets}) = P(\text{L L}) = 0{,}6 \cdot 0{,}6 = 0{,}36.$

31b $P(\text{Gijs wint de eerste en Lotte de volgende twee sets}) = P(\text{G L L}) = 0{,}4 \cdot 0{,}6 \cdot 0{,}6 = 0{,}144.$

```
0.6²
              .36
0.4*0.6²
             .144
```

31c $P(\text{de partij duurt drie sets}) = P(\underline{\underline{\text{G L}}}\text{ L}) + P(\underline{\underline{\text{G L}}}\text{ G}) = \binom{2}{1} \cdot 0{,}4 \cdot 0{,}6 \cdot 0{,}6 + \binom{2}{1} \cdot 0{,}4 \cdot 0{,}6 \cdot 0{,}4 = 0{,}48.$

```
2 nCr 1*0.4*0.6²
+2 nCr 1*0.4*0.6
*0.4
              .48
```

32a $P(\text{Barney wint in twee sets}) = P(\text{B B}) = 0{,}65 \cdot 0{,}65 \approx 0{,}423.$

32b $P(\text{de partij is afgelopen in twee sets}) = P(\text{B B}) + P(\text{F F}) = 0{,}65 \cdot 0{,}65 + 0{,}35 \cdot 0{,}35 = 0{,}545.$

32c $P(\text{Barney wint}) = P(\text{B B}) + P(\underline{\underline{\text{B F}}}\text{ B}) = 0{,}65 \cdot 0{,}65 + \binom{2}{1} \cdot 0{,}65 \cdot 0{,}35 \cdot 0{,}65 \approx 0{,}718.$

```
0.65²
            .4225
Ans+0.35²
             .545
0.65²+2 nCr 1*0.
65*0.35*0.65
           .71825
```

33a $P(\text{bij de tweede herkansing slagen}) = P(\text{bij derde examen slagen}) = P(\bar{s}\,\bar{s}\,s) = 0,4 \cdot 0,7 \cdot 0,3 = 0,084.$

33b $P(\text{defintief afgewezen}) = P(\text{bij vierde examen niet slagen}) = P(\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}) = 0,4 \cdot 0,7 \cdot 0,7 \cdot 0,7 \approx 0,137.$

```
0.4*0.7*0.3
             .084
0.4*0.7^3
            .1372
```

34a $P(\text{vier keer gooien}) = P(\bar{4}\,\bar{4}\,\bar{4}\,4) = \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{1}{4} \approx 0,105.$

34b $P(\text{zes keer gooien}) = P(\bar{4}\,\bar{4}\,\bar{4}\,\bar{4}\,\bar{4}\,4) = (\frac{3}{4})^5 \cdot \frac{1}{4} \approx 0,059.$

34c $P(\text{minder dan drie keer gooien}) = P(4) + P(\bar{4}\,4) = \frac{1}{4} + \frac{3}{4} \cdot \frac{1}{4} \approx 0,438.$

```
(3/4)^3*1/4
       .10546875
(3/4)^5*1/4
     .0593261719
1/4+3/4*1/4
           .4375
```

34d $P(\text{minstens drie keer gooien}) = 1 - P(\text{minder dan drie keer gooien}) = 1 - P(4) - P(\bar{4}\,4) \approx 1 - 0,438 = 0,562.$

```
1-1/4-3/4*1/4
           .5625
```

35a Een jaar heeft 365 dagen, dus als $n > 365$ mensen dan zijn er minstens twee op dezelfde dag jarig.

35b Laat ze één voor één de datum van hun verjaardag noemen. Voor de eerste persoon zijn er geen beperkingen. Voor de tweede persoon zijn er nog 364 van de 365 dagen over en voor de derde persoon nog 363 van de 365.

35c $P(\text{alle 5 op verschillende dagen jarig}) = \frac{365}{365} \cdot \frac{364}{365} \cdot \frac{363}{365} \cdot \frac{362}{365} \cdot \frac{361}{365} \approx 0,973.$

35d $P(\text{minstens 2 op dezelfde dag jarig}) = 1 - P(\text{minder dan 2 op dezelfde dag jarig})$
$= 1 - P(\text{alle 5 op verschillende dagen jarig}) \approx 1 - 0,973 = 0,027.$

```
365*364*363*362*
361/365^5
     .9728644263
1-Ans
     .0271355737
```

35e $P(\text{minstens 2 op dezelfde dag jarig}) = 1 - P(\text{minder dan 2 op dezelfde dag jarig})$
$= 1 - P(\text{alle 30 op verschillende dagen jarig}) = 1 - \frac{365}{365} \cdot \frac{364}{365} \cdot \frac{363}{365} \cdot \ldots \cdot \frac{336}{365} = 1 - \frac{365\text{nPr}30}{365^{30}} \approx 0,706.$

```
1-365 nPr 30/365
^30
     .7063162427
```

35f Johnny Carson keek alleen naar de kans dat iemand op dezelfde dag jarig was als hij.
Dat is wat anders dan de kans dat er in de hele groep minstens twee mensen op dezelfde dag jarig zijn.

36a aantal $= \binom{7}{4} = 35.$ 36b aantal $= \binom{8}{2} \cdot \binom{7}{2} = 588.$ 36c aantal $= \binom{8}{3} \cdot \binom{12}{1} = 672.$

```
7 nCr 4
              35
8 nCr 2*7 nCr 2
             588
8 nCr 3*12 nCr 1
             672
```

37a $P(rood = 3) = P(\underline{\underline{r\,r\,r\,\bar{r}\,\bar{r}}}) = \frac{\binom{6}{3} \cdot \binom{9}{2}}{\binom{15}{5}} \approx 0,240$ of

$P(rood = 3) = P(\underline{\underline{r\,r\,r\,\bar{r}\,\bar{r}}}) = \binom{5}{3} \cdot P(r\,r\,r\,\bar{r}\,\bar{r}) = \binom{5}{3} \cdot \frac{6}{15} \cdot \frac{5}{14} \cdot \frac{4}{13} \cdot \frac{9}{12} \cdot \frac{8}{11} \approx 0,240.$

```
6 nCr 3*9 nCr 2/
15 nCr 5
     .2397602398
5 nCr 3*6*5*4*9*
8/15/14/13/12/11
     .2397602398
```

37b $P(wit \geq 1) = 1 - P(wit = 0) = 1 - P(\bar{w}\,\bar{w}\,\bar{w}\,\bar{w}\,\bar{w}) = 1 - \frac{\binom{10}{5}}{\binom{15}{5}} \approx 0,916$ of

$P(wit \geq 1) = 1 - P(wit = 0) = 1 - P(\bar{w}\,\bar{w}\,\bar{w}\,\bar{w}\,\bar{w}) = 1 - \frac{10}{15} \cdot \frac{9}{14} \cdot \frac{8}{13} \cdot \frac{7}{12} \cdot \frac{6}{11} \approx 0,916.$

```
1-10 nCr 5/15 nC
r 5
     .9160839161
1-10*9*8*7*6/15/
14/13/12/11
     .9160839161
```

37c $P(groen \leq 1) = P(groen = 0) + P(groen = 1) = P(\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}) + P(\underline{\underline{g\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}}}) = \frac{\binom{11}{5}}{\binom{15}{5}} + \frac{\binom{4}{1} \cdot \binom{11}{4}}{\binom{15}{5}} \approx 0,593$ of

$P(groen \leq 1) = P(groen = 0) + P(groen = 1) = P(\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}) + P(\underline{\underline{g\,\bar{g}\,\bar{g}\,\bar{g}\,\bar{g}}}) = \frac{11}{15} \cdot \frac{10}{14} \cdot \frac{9}{13} \cdot \frac{8}{12} \cdot \frac{7}{11} + \binom{5}{1} \cdot \frac{4}{15} \cdot \frac{11}{14} \cdot \frac{10}{13} \cdot \frac{9}{12} \cdot \frac{8}{11} \approx 0,593.$

```
(11 nCr 5+4 nCr
1*11 nCr 4)/15 n
Cr 5
     .5934065934
```

```
(11*10*9*8*7+5 n
Cr 1*4*11*10*9*8
)/15/14/13/12/11
     .5934065934
```

37d $P(rood = 0) = P(\bar{r}\,\bar{r}\,\bar{r}\,\bar{r}\,\bar{r}) = \frac{\binom{9}{5}}{\binom{15}{5}} \approx 0,042$ of $P(rood = 0) = P(\bar{r}\,\bar{r}\,\bar{r}\,\bar{r}\,\bar{r}) = \frac{9}{15} \cdot \frac{8}{14} \cdot \frac{7}{13} \cdot \frac{6}{12} \cdot \frac{5}{11} \approx 0,042.$

```
9 nCr 5/15 nCr 5
      .041958042
9*8*7*6*5/15/14/
13/12/11
      .041958042
```

38a $P(prijs \geq 1) = 1 - P(prijs = 0) = 1 - P(\bar{p}\,\bar{p}\,\bar{p}\,\bar{p}\,\bar{p}\,\bar{p}) = 1 - \frac{\binom{84}{6}}{\binom{100}{6}} \approx 0,659.$

```
1-84 nCr 6/100 n
Cr 6
     .6590069833
```

38b $P(prijs = 2) = P(\underline{\underline{p\,p\,\bar{p}\,\bar{p}\,\bar{p}\,\bar{p}}}) = \frac{\binom{16}{2} \cdot \binom{84}{4}}{\binom{100}{6}} \approx 0,194.$

```
16 nCr 2*84 nCr
4/100 nCr 6
     .1942365285
```

38c $P(\text{één tweede prijs en twee troostprijzen}) = P(\underline{\underline{\text{'}2^{e}\text{' '}2^{e}\text{' 't' }\bar{p}\,\bar{p}}}) = \frac{\binom{5}{1} \cdot \binom{10}{2} \cdot \binom{84}{3}}{\binom{100}{6}} \approx 0,018.$

```
5 nCr 1*10 nCr 2
*84 nCr 3/100 nC
r 6
     .0179848638
```

39a 25% van 28 $= \frac{1}{4} \cdot 27 = 7 \Rightarrow P(lid = 2) = P(\text{l l}) = \dfrac{\binom{7}{2}}{\binom{28}{2}} \approx 0{,}056.$

```
7 nCr 2/28 nCr 2
         .0555555556
```

39b Nee, in 39b kan twee keer dezelfde sector worden aangewezen. (bij 39a kies je niet twee keer dezelfde leerling)

40a $P(groen = 2) = P(\underline{\underline{g\,g\,\bar{g}}}) = \dfrac{\binom{16}{2} \cdot \binom{24}{1}}{\binom{40}{3}} \approx 0{,}291.$

```
16 nCr 2*24 nCr
1/40 nCr 3
        .2914979757
```

40b $P(blauw \geq 1) = 1 - P(blauw = 0) = 1 - P(\bar{b}\,\bar{b}\,\bar{b}) = 1 - \dfrac{\binom{16}{3}}{\binom{40}{3}} \approx 0{,}943.$

```
1-16 nCr 3/40 nC
r 3
        .9433198381
```

40c $P(groen = 2) = P(\underline{\underline{g\,g\,\bar{g}}}) = \binom{3}{2} \cdot P(g\,g\,\bar{g}) = \binom{3}{2} \cdot \frac{16}{40} \cdot \frac{16}{40} \cdot \frac{24}{40} = 0{,}288.$

40d $P(blauw \geq 1) = 1 - P(blauw = 0) = 1 - P(\bar{b}\,\bar{b}\,\bar{b}) = 1 - \frac{16}{40} \cdot \frac{16}{40} \cdot \frac{16}{40} = 0{,}936.$

```
3 nCr 2*(16/40)²
*24/40
              .288
1-(16/40)^3
              .936
```

41a $P(meisjes = 4) = P(\text{m m m m}) = (\frac{12}{22})^4 \approx 0{,}089.$

41b $P(meisjes = 4) = P(\text{m m m m}) = \dfrac{\binom{12}{4}}{\binom{22}{4}} \approx 0{,}068.$

```
(12/22)^4
        .0885185438
12 nCr 4/22 nCr
4
        .0676691729
```

42a $P(vrouwen = 3) = P(\text{v v v}) = \dfrac{\binom{38}{3}}{\binom{60}{3}} \approx 0{,}247.$

42b $P(vrouwen = 3) = P(\text{v v v}) = \frac{38}{60} \cdot \frac{38}{60} \cdot \frac{38}{60} = 0{,}254.$

```
38 nCr 3/60 nCr
3
        .2465225015
(38/60)^3
        .254037037
```

43a $P(rood = 2) = P(\underline{\underline{r\,r\,\bar{r}\,\bar{r}\,\bar{r}}}) = \dfrac{\binom{3}{2} \cdot \binom{7}{3}}{\binom{10}{5}} \approx 0{,}417.$

43b $P(rood = 2) = \dfrac{\binom{30}{2} \cdot \binom{70}{3}}{\binom{100}{5}} \approx 0{,}316.$

```
3 nCr 2*7 nCr 3/
10 nCr 5
        .4166666667
30 nCr 2*70 nCr
3/100 nCr 5
        .3162795109
```

43c $P(rood = 2) = \dfrac{\binom{300}{2} \cdot \binom{700}{3}}{\binom{1000}{5}} \approx 0{,}309.$

43d $P(rood = 2) = \dfrac{\binom{3000}{2} \cdot \binom{7000}{3}}{\binom{10000}{5}} \approx 0{,}309.$

```
300 nCr 2*700 nC
r 3/1000 nCr 5
        .3094372232
3000 nCr 2*7000
nCr 3/10000 nCr
5
        .3087735222
```

43e $P(rood = 2) = P(\underline{\underline{r\,r\,\bar{r}\,\bar{r}\,\bar{r}}}) = \binom{5}{2} \cdot P(r\,r\,\bar{r}\,\bar{r}\,\bar{r}) = \binom{5}{2} \cdot 0{,}3^2 \cdot 0{,}7^3 \approx 0{,}309.$

(N.B.: $\frac{3}{10} = \frac{30}{100} = \frac{300}{1000} = \frac{3000}{10000} = 0{,}3$ en $\frac{7}{10} = \frac{70}{100} = \frac{700}{1000} = \frac{7000}{10000} = 0{,}7$)

```
5 nCr 2*0.3²*0.7
^3
             .3087
```

44a $P(e\text{-}winkelen = 0) = P(\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}) = (1 - 0{,}30)^{15} = 0{,}70^{15} \approx 0{,}005.$

44b $P(e\text{-}winkelen = 2) = P(\underline{\underline{e\,e\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}}}) = \binom{15}{2} \cdot 0{,}30^2 \cdot 0{,}70^{13} \approx 0{,}092.$

```
0.7^15
        .0047475615
15 nCr 2*0.3²*0.
7^13
        .0915601148
```

```
1-0.7^15-15 nCr
1*0.3*0.7^14
        .9647324002
```

44c $P(e\text{-}winkelen \geq 2) = 1 - P(e\text{-}winkelen < 2) = 1 - P(e\text{-}winkelen = 0) - P(e\text{-}winkelen = 1) = 1 - 0{,}70^{15} - \binom{15}{1} \cdot 0{,}30 \cdot 0{,}70^{14} \approx 0{,}965.$

45a $P(bijtend = 0) = P(\overline{by}\,\overline{by}\,\overline{by}\,\overline{by}\,\overline{by}\,\overline{by}\,\overline{by}\,\overline{by}\,\overline{by}\,\overline{by}) = (1 - 0{,}15)^{10} = 0{,}85^{10} \approx 0{,}197.$

45b $P(brandbaar = 8 \text{ én } bijtend = 2) = P(\underline{\underline{\text{br br br br br br br br by by}}}) = \binom{10}{2} \cdot 0{,}60^8 \cdot 0{,}15^2 \approx 0{,}017.$

45c $P(brandbaar \geq 9) = P(brandbaar = 9) + P(brandbaar = 10) = \binom{10}{1} \cdot 0{,}60^9 \cdot 0{,}40 + 0{,}60^{10} \approx 0{,}046.$

```
0.85^10
        .1968744043
10 nCr 2*0.6^8*0
.15²
        .017006112
```

```
10 nCr 1*0.6^9*0
.4+0.6^10
        .0463574016
```

46a $P(linkshandig = 1) = P(\underline{\underline{l\,r}}) = \binom{2}{1} \cdot P(l\,r) = \binom{2}{1} \cdot 0{,}18 \cdot 0{,}82 \approx 0{,}295.$

```
2 nCr 1*0.18*0.8
2
             .2952
```

46b $P(linkshandig \leq 1) = P(linkshandig = 0) + P(linkshandig = 1) = P(r\,r\,r\,r\,r) + P(\underline{\underline{l\,r\,r\,r\,r}}) = 0{,}82^5 + \binom{5}{1} \cdot 0{,}18 \cdot 0{,}82^4 \approx 0{,}778.$

```
0.82^5+5 nCr 1*0
.18*0.82^4
        .7776494272
```

46c $P(linkshandig \geq 1) = 1 - P(linkshandig < 1) = 1 - P(linkshandig = 0) = 1 - P(r\,r\,r \ldots r\,r) = 1 - 0{,}82^n > 0{,}99.$
Bladeren in de tabel $\Rightarrow n \geq 24 \Rightarrow$ gezelschap moet uit minstens 24 personen bestaan.

```
Plot1 Plot2 Plot3
\Y1=1-0.82^X
\Y2=0.99
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

X	Y1	Y2
20	.98111	.99
21	.98451	.99
22	.9873	.99
23	.98958	.99
24	.99146	.99
25	.993	.99
26	.99426	.99

X=24

46d $P(linkshandig = 2) = P(\text{l l}) = \dfrac{\binom{9}{2}}{\binom{50}{2}} \approx 0{,}029.$

```
9 nCr 2/50 nCr 2
        .0293877551
```

47a $P(succes=0)=P(\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s})=(1-0{,}06)^{12}=0{,}94^{12}\approx 0{,}476.$

```
0.94^12
      .4759203148
```

(succes is hier "klagers buiten een straal van 30 km van Schiphol")

```
0.15-0.06
              .09
1-Ans
              .91
12 nCr 2*0.09²*0
.91^10
      .2081818567
```

47b $P(succes=2)=P(\underline{\underline{s\,s\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}}})=\binom{12}{2}\cdot P(s\,s\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,\bar{s})=\binom{12}{2}\cdot 0{,}09^2\cdot 0{,}91^{10}\approx 0{,}208.$

(succes is hier "klagers in een straal van tussen 20 en 30 km van Schiphol")

```
12 nCr 2*0.06²*0
.85^10
      .0467773585
```

47c $P(succes=2 \text{ en } binnen=10)=P(\underline{\underline{s\,s\,b\,b\,b\,b\,b\,b\,b\,b\,b\,b}})=\binom{12}{2}\cdot P(s\,s\,b\,b\,b\,b\,b\,b\,b\,b\,b\,b)=\binom{12}{2}\cdot 0{,}06^2\cdot 0{,}85^{10}\approx 0{,}047.$

(succes is hier "klagers buiten een straal van 30 km van Schiphol" en binnen is "klagers binnen een straal van 20 km")

48a $P(eenoudergezin=0)=P(\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\,\bar{e})=(1-0{,}12)^{11}=0{,}88^{11}\approx 0{,}245.$

```
0.88^11
      .2450808589
```

48b $P(eenoudergezin\le 2)=P(eenoudergezin=0)+P(eenoudergezin=1)+P(eenoudergezin=2)$

$=P(\bar{e}\,\bar{e}\,\bar{e}\,\bar{e}\ldots\bar{e})+P(\underline{\underline{e\,\bar{e}\,\bar{e}\,\bar{e}\ldots\bar{e}}})+P(\underline{\underline{e\,e\,\bar{e}\,\bar{e}\ldots\bar{e}}})=0{,}88^{22}+\binom{22}{1}\cdot 0{,}12\cdot 0{,}88^{21}+\binom{22}{2}\cdot 0{,}12^2\cdot 0{,}88^{20}\approx 0{,}498.$

```
0.88^22+22 nCr 1
*0.12*0.88^21+22
 nCr 2*0.12²*0.8
8^20
      .4982633863
```

48c $P(eenoudergezin=2)=\dfrac{\binom{5}{2}\cdot\binom{30}{4}}{\binom{35}{6}}\approx 0{,}169.$

```
5 nCr 2*30 nCr 4
/35 nCr 6
      .1688373297
```

49a $P(lopen\ge 2)=1-P(lopen<2)=1-P(lopen=0)-P(lopen=1)=1-P(\bar{r}\,\bar{r}\,\bar{r}\,\bar{r}\ldots\bar{r})-P(\underline{\underline{r\,\bar{r}\,\bar{r}\,\bar{r}\ldots\bar{r}}})$ (hier is r "de rest" $\Rightarrow$ lopend)

$=1-P(\bar{r}\,\bar{r}\,\bar{r}\,\bar{r}\ldots\bar{r})-\binom{18}{1}\cdot P(r\,\bar{r}\,\bar{r}\,\bar{r}\ldots\bar{r})=1-0{,}95^{18}-\binom{18}{1}\cdot 0{,}05\cdot 0{,}95^{17}\approx 0{,}226.$

```
1-0.95^18-18 nCr
 1*0.05*0.95^17
      .2264773798
```

49b $P(fietsen=4 \text{ of } fietsen=5)=P(\underline{\underline{f\,f\,f\,f\,\bar{f}\,\bar{f}\,\bar{f}\ldots\bar{f}}})+P(\underline{\underline{f\,f\,f\,f\,f\,\bar{f}\,\bar{f}\ldots\bar{f}}})=\binom{18}{4}\cdot P(f\,f\,f\,f\,\bar{f}\,\bar{f}\,\bar{f}\ldots\bar{f})+\binom{18}{5}\cdot P(f\,f\,f\,f\,f\,\bar{f}\,\bar{f}\ldots\bar{f})$

$=\binom{18}{4}\cdot 0{,}25^4\cdot 0{,}75^{14}+\binom{18}{5}\cdot 0{,}25^5\cdot 0{,}75^{13}\approx 0{,}412.$

```
18 nCr 4*0.25^4*
0.75^14+18 nCr 5
*0.25^5*0.75^13
      .4117616424
```

```
18 nCr 12*0.6^12
*0.25^6
      .0098656707
```

49c $P(auto=12 \text{ én } fietsen=6)=P(\underline{\underline{a\,a\,a\,a\ldots a\,f\,f\,f\,f\,f\,f}})=\binom{18}{12}\cdot P(a\,a\,a\,a\ldots a\,f\,f\,f\,f\,f\,f)=\binom{18}{12}\cdot 0{,}60^{12}\cdot 0{,}25^6\approx 0{,}010.$

```
18 nCr 4*0.3^4*0
.7^14
      .1681043708
```

49d $P(\text{"}fietsen \text{ of } lopen\text{"}=4)=P(\underline{\underline{s\,s\,s\,s\,\bar{s}\,\bar{s}\,\bar{s}\ldots\bar{s}}})=\binom{18}{4}\cdot P(s\,s\,s\,s\,\bar{s}\,\bar{s}\,\bar{s}\ldots\bar{s})=\binom{18}{4}\cdot 0{,}30^4\cdot 0{,}70^{14}\approx 0{,}168.$

```
0.4*18
              7.2
0.6*18
             10.8
```

49e $P(7{,}2<auto<10{,}8)=P(auto=8)+P(auto=9)+P(auto=10)$

$=\binom{18}{8}\cdot 0{,}60^8\cdot 0{,}40^{10}+\binom{18}{9}\cdot 0{,}60^9\cdot 0{,}40^9+\binom{18}{10}\cdot 0{,}60^{10}\cdot 0{,}40^8\approx 0{,}379.$

```
18 nCr 8*0.6^8*0
.4^10+18 nCr 9*0
.6^9*0.4^9+18 nC
r 10*0.6^10*0.4^
8
      .3789118137
```

50a $P(X=17)=\frac{5}{25}=0{,}2.$ 50b $P(Y=1)=\frac{8}{25}=0{,}32.$ 50c $P(X=16 \text{ én } Y=1)=\frac{7}{25}=0{,}28.$

```
5/25
               .2
8/25
              .32
7/25
              .28
```

51a $P(X\ge 3)=1-P(X\le 2).$

51b $P(X\ge 3)=P(X=3)+P(X=4)+P(X=5).$

51c $P(X<2)=P(X\le 1)=P(X=0)+P(X=1).$

51d $P(\text{minstens één rode})=P(X\ge 1).$

51e $P(\text{hoogstens drie rode})=P(X\le 3).$

51f $P(\text{minder dan twee rode})=P(X<2).$

52a $P(X=2)=\dfrac{\binom{5}{2}\cdot\binom{5}{2}}{\binom{10}{4}}\approx 0{,}476.$ 52b $P(X\ge 1)=1-P(X<1)=1-P(X=0)=1-\dfrac{\binom{5}{4}}{\binom{10}{4}}\approx 0{,}976.$

```
5 nCr 2*5 nCr 2/
10 nCr 4
      .4761904762
1-5 nCr 4/10 nCr
 4
      .9761904762
```

53a • $X>10.$ • $X\ge 10.$ • $X\le 10.$

53b $P(X=3)=\frac{2}{36}\approx 0{,}056$ (zie het rooster hiernaast).

$P(X\ge 10)=\frac{6}{36}\approx 0{,}167$ (zie het rooster hiernaast).

```
2/36
      .0555555556
6/36
      .1666666667
```

6	7	8	9	10	11	12
5	6	7	8	9	10	11
4	5	6	7	8	9	10
3	4	5	6	7	8	9
2	3	4	5	6	7	8
1	2	3	4	5	6	7
+	**1**	**2**	**3**	**4**	**5**	**6**

54a $P(X=20)=\dfrac{\binom{8}{2}}{\binom{20}{2}}\approx 0{,}147.$

```
8 nCr 2/20 nCr 2
      .1473684211
```

54b $P(X>0)=1-P(X=0)=1-\dfrac{\binom{12}{2}}{\binom{20}{2}}\approx 0{,}653.$

```
1-12 nCr 2/20 nC
r 2
      .6526315789
```

55a $P(X=16)=\frac{25}{83}\approx 0{,}301.$

```
25/83
      .3012048193
```

55b $P(X=16)+P(X=17)+P(X=18)=\frac{25}{83}+\frac{40}{83}+\frac{18}{83}=\frac{83}{83}=1.$

56a $P(X=2)=P(\underline{\underline{w\,w\,\bar{w}\,\bar{w}\,\bar{w}}})=\dfrac{\binom{5}{2}\cdot\binom{10}{3}}{\binom{15}{5}}\approx 0{,}400.$

```
5 nCr 2*10 nCr 3
/15 nCr 5
      .3996003996
```

56b $P(Y=0)=P(\bar{r}\,\bar{r}\,\bar{r}\,\bar{r})=(\frac{7}{15})^4\approx 0{,}047.$

```
(7/15)^4
      .0474271605
1-(8/15)^4
       .919091358
```

56c $P(Y\le 3)=1-P(Y>3)=1-P(Y=4)=1-P(r\,r\,r\,r)=1-(\frac{8}{15})^4\approx 0{,}919.$

57 $P(X=1)=P(\text{r})=\frac{6}{10}=0{,}6.$

$P(X=2)=P(\bar{\text{r}}\,\text{r})=\frac{4}{10}\cdot\frac{6}{9}\approx 0{,}267.$

$P(X=3)=P(\bar{\text{r}}\,\bar{\text{r}}\,\text{r})=\frac{4}{10}\cdot\frac{3}{9}\cdot\frac{6}{8}=0{,}1.$

$P(X=4)=P(\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\text{r})=\frac{4}{10}\cdot\frac{3}{9}\cdot\frac{2}{8}\cdot\frac{6}{7}\approx 0{,}029.$

$P(X=5)=P(\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\text{r})=\frac{4}{10}\cdot\frac{3}{9}\cdot\frac{2}{8}\cdot\frac{1}{7}\cdot\frac{6}{6}\approx 0{,}005.$

```
6/10
                .6
4/10*6/9
      .2666666667
4/10*3/9*6/8
                .1
```

```
4/10*3/9*2/8*6/7
      .0285714286
4/10*3/9*2/8*1/7
*6/6
      .0047619048
```

Kansverdeling van toevalsvariabele X.

x	1	2	3	4	5
$P(X=x)$	0,6	0,267	0,1	0,029	0,005

58a $P(X=3)=P(CCC)+P(\text{NNN})=0{,}6^3+0{,}4^3=0{,}28.$

58b $P(X=4)=P(\underline{\underline{CCN}}C)+P(\underline{\underline{\text{NNC}}}\text{N})=\binom{3}{2}\cdot 0{,}6^2\cdot 0{,}4\cdot 0{,}6+\binom{3}{2}\cdot 0{,}4^2\cdot 0{,}6\cdot 0{,}4=0{,}374.$

$P(X=5)=P(\underline{\underline{CCNN}}C)+P(\underline{\underline{\text{NNCC}}}\text{N})=\binom{4}{2}\cdot 0{,}6^2\cdot 0{,}4^2\cdot 0{,}6+\binom{4}{2}\cdot 0{,}4^2\cdot 0{,}6^2\cdot 0{,}4=0{,}346.$

Hiernaast de kansverdeling van toevalsvariabele X.

```
0.6^3+0.4^3
               .28
3 nCr 2*0.6^3*0.
4+3 nCr 2*0.4^3*
0.6
             .3744
```

```
4 nCr 2*0.6^3*0.
4²+4 nCr 2*0.4^3
*0.6²
             .3456
1-0.28-0.3744
             .3456
```

x	3	4	5
$P(X=x)$	0,28	0,374	0,346

59a $P(X=2)=P(\underline{\underline{\text{r r}\,\bar{\text{r}}}})=\binom{3}{2}\cdot P(\text{r r}\,\bar{\text{r}})=\binom{3}{2}\cdot(\frac{8}{18})^2\cdot\frac{10}{18}\approx 0{,}329.$

59b $P(Y=3)=P(\underline{\underline{\text{r b w}}})=3!\cdot P(\text{r b w})=3!\cdot\frac{8}{18}\cdot\frac{4}{18}\cdot\frac{6}{18}\approx 0{,}198.$

```
3 nCr 2*(8/18)²*
10/18
       .329218107
3!*8/18*4/18*6/1
8
      .1975308642
```

60a Alle staven van het kanshistogram zijn even lang.

60b $X=\begin{cases}0 \text{ bij kop}\\ 1 \text{ bij munt}\end{cases}\Rightarrow P(X=0)=P(X=1)=\frac{1}{2}.$

60c Vier even grote sectoren met de getallen 1, 2, 3 en 4 $\Rightarrow P(X=1)=P(X=2)=P(X=3)=P(X=4)=\frac{1}{4}.$

61a $P(X=8)=P(\underline{\underline{\text{zzzzzzzz}\bar{\text{z}}\bar{\text{z}}}})=\binom{10}{8}\cdot P(\text{zzzzzzzz}\bar{\text{z}}\bar{\text{z}})=\binom{10}{8}\cdot 0{,}8^8\cdot 0{,}2^2\approx 0{,}302.$

61b $P(X<9)=1-P(X\geq 9)=1-P(X=9)-P(X=10)=1-P(\underline{\underline{\text{zzzzzzzzz}\bar{\text{z}}}})-P(\text{zzzzzzzzzz})$

$=1-\binom{10}{9}\cdot P(\text{zzzzzzzzz}\bar{\text{z}})-P(\text{zzzzzzzzzz})=1-\binom{10}{9}\cdot 0{,}8^9\cdot 0{,}2-0{,}8^{10}\approx 0{,}624.$

```
10 nCr 8*0.8^8*0
.2²
       .301989888
1-10 nCr 9*0.8^9
*0.2-0.8^10
      .6241903616
```

62a $P(X=7)=P(\underline{\underline{\text{eeeeeee}\bar{\text{e}}\bar{\text{e}}\bar{\text{e}}\bar{\text{e}}\bar{\text{e}}}})=\binom{12}{7}\cdot P(\text{eeeeeee}\bar{\text{e}}\bar{\text{e}}\bar{\text{e}}\bar{\text{e}}\bar{\text{e}})=\binom{12}{7}\cdot 0{,}58^7\cdot 0{,}42^5\approx 0{,}229.$

62b $P(Y=4)=P(\underline{\underline{\text{mmmm}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}}})=\binom{12}{4}\cdot P(\text{mmmm}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}})=\binom{12}{4}\cdot 0{,}32^4\cdot 0{,}68^8\approx 0{,}237.$

```
12 nCr 7*0.58^7*
0.42^5
      .2285428235
12 nCr 4*0.32^4*
0.68^8
      .2372883486
```

62c $P(Y\geq 2)=1-P(Y<2)=1-P(Y=0)-P(Y=1)=1-P(\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\ldots\bar{\text{m}})-P(\underline{\underline{\text{m}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\ldots\bar{\text{m}}}})$

$=1-P(\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\ldots\bar{\text{m}})-\binom{12}{1}\cdot P(\text{m}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\bar{\text{m}}\ldots\bar{\text{m}})=1-0{,}68^{12}-\binom{12}{1}\cdot 0{,}32\cdot 0{,}68^{11}\approx 0{,}935.$

62d $P(X=8 \text{ en } Y=4)=P(\underline{\underline{\text{eeeeeeeemmmm}}})=\binom{12}{8}\cdot P(\text{eeeeeeeemmmm})=\binom{12}{8}\cdot 0{,}58^8\cdot 0{,}32^4\approx 0{,}066.$

```
1-0.68^12-12 nCr
 1*0.32*0.68^11
      .9350264682
12 nCr 8*0.58^8*
0.32^4
      .0664705176
```

63a $P(X=0)=\frac{17}{24}\approx 0{,}708$ en $P(X=1)=\frac{6}{24}=0{,}25.$

```
17/24
      .7083333333
6/24
               .25
```

63b $P(X=1\,|\,Y=0)=\frac{X=1 \text{ én } Y=0}{Y=0}=\frac{2}{8}.$

63c $P(X=1\,|\,Y=0)=\frac{X=1 \text{ én } Y=0}{Y=0}=\frac{2}{8}=\frac{1}{4}$ en $P(X=1)=\frac{6}{24}$ (zie 63a) $=\frac{1}{4}\Rightarrow P(X=1\,|\,Y=0)=P(X=1).$

$P(X=1\,|\,Y=1)=\frac{X=1 \text{ én } Y=1}{Y=0}=\frac{4}{16}=\frac{1}{4}$ en $P(X=1)=\frac{6}{24}$ (zie 63a) $=\frac{1}{4}\Rightarrow P(X=1\,|\,Y=1)=P(X=1).$

63de $P(X=0\,|\,Y=0)=\frac{X=0 \text{ én } Y=0}{Y=0}=\frac{5}{8}$ en $P(X=0)=\frac{17}{24}$ (zie 63a) $\neq\frac{5}{8}=\frac{15}{24}\Rightarrow P(X=0\,|\,Y=0)\neq P(X=0).$

64a $P(X=15\,|\,Y=0)=\frac{X=15 \text{ én } Y=0}{Y=0}=\frac{25}{50}=\frac{1}{2}.$

64c $P(X=15\,|\,Y=1)=\frac{X=15 \text{ én } Y=1}{Y=1}=\frac{0}{25}=0.$

64b $P(X=17\,|\,Y=0)=\frac{X=17 \text{ én } Y=0}{Y=0}=\frac{0}{50}=0.$

64d $P(X=15)=\frac{25}{80}\neq 0\Rightarrow X$ en Y zijn (niet on)afhankelijk .

65a $P(X=2)=\frac{1}{36}.$

65b $P(X=2\,|\,Y=3)=\frac{X=2 \text{ én } Y=3}{Y=3}=\frac{0}{2}=0.$

65c $P(X=2\,|\,Y=3)\neq P(X=2)\Rightarrow X$ en Y zijn (niet on)afhankelijk.

Diagnostische toets

D1a $P(\text{met elke meer dan vier ogen}) = \frac{2}{6}\times\frac{2}{6}\times\frac{2}{6}\times\frac{2}{6} = \frac{1}{81}$.

D1b $P(\bar{6}\,\bar{6}\,\bar{6}\,\bar{6}) = \frac{5}{6}\cdot\frac{5}{6}\cdot\frac{5}{6}\cdot\frac{5}{6} = \frac{625}{1296}$.

D1c $P(\text{met minstens één meer dan twee ogen}) = 1 - P(\text{met geen enkele meer dan twee ogen}) = 1 - \frac{2}{6}\times\frac{2}{6}\times\frac{2}{6}\times\frac{2}{6} = \frac{80}{81}$.

```
(2/6)^4▸Frac
            1/81
(5/6)^4▸Frac
        625/1296
1-(2/6)^4▸Frac
           80/81
```

D2a $P(\text{K K K}) = \frac{2}{5}\cdot\frac{1}{3}\cdot\frac{1}{4} \approx 0{,}033$.

D2b $P(\underline{\underline{\text{P}\,\bar{\text{P}}\,\bar{\text{P}}}}) = P(\text{P}\,\bar{\text{P}}\,\bar{\text{P}}) + P(\bar{\text{P}}\,\text{P}\,\bar{\text{P}}) + P(\bar{\text{P}}\,\bar{\text{P}}\,\text{P}) = \frac{2}{5}\cdot\frac{2}{3}\cdot\frac{3}{4} + \frac{3}{5}\cdot\frac{1}{3}\cdot\frac{3}{4} + \frac{3}{5}\cdot\frac{2}{3}\cdot\frac{1}{4} = 0{,}45$.

```
2/5*1/3*1/4
     .0333333333
2/5*2/3*3/4+3/5*
1/3*3/4+3/5*2/3*
1/4
             .45
```

D2c $P(S \geq 2) = P(\underline{\underline{\text{S S }\bar{\text{S}}}}) + P(\text{S S S}) = P(\text{S S }\bar{\text{S}}) + P(\text{S }\bar{\text{S}}\text{ S}) + P(\bar{\text{S}}\text{ S S}) + P(\text{S S S}) = \frac{1}{5}\cdot\frac{1}{3}\cdot\frac{2}{4} + \frac{1}{5}\cdot\frac{2}{3}\cdot\frac{2}{4} + \frac{4}{5}\cdot\frac{1}{3}\cdot\frac{2}{4} + \frac{1}{5}\cdot\frac{1}{3}\cdot\frac{2}{4} \approx 0{,}267$.

D2d $P(\text{drie keer dezelfde letter}) = P(\text{K K K}) + P(\text{P P P}) + P(\text{S S S}) = \frac{2}{5}\cdot\frac{1}{3}\cdot\frac{1}{4} + \frac{2}{5}\cdot\frac{1}{3}\cdot\frac{1}{4} + \frac{1}{5}\cdot\frac{1}{3}\cdot\frac{2}{4} = 0{,}1$.

D2e $P(K \leq 1) = P(K = 0) + P(K = 1) = P(\bar{\text{K}}\,\bar{\text{K}}\,\bar{\text{K}}) + P(\underline{\underline{\text{K}\,\bar{\text{K}}\,\bar{\text{K}}}}) = P(\bar{\text{K}}\,\bar{\text{K}}\,\bar{\text{K}}) + P(\text{K}\,\bar{\text{K}}\,\bar{\text{K}}) + P(\bar{\text{K}}\,\text{K}\,\bar{\text{K}}) + P(\bar{\text{K}}\,\bar{\text{K}}\,\text{K})$

$= \frac{3}{5}\cdot\frac{2}{3}\cdot\frac{3}{4} + \frac{2}{5}\cdot\frac{2}{3}\cdot\frac{3}{4} + \frac{3}{5}\cdot\frac{1}{3}\cdot\frac{3}{4} + \frac{3}{5}\cdot\frac{2}{3}\cdot\frac{1}{4} = 0{,}75$.

```
(1*1*2+1*2*2+4*1
*2+1*1*2)/5/3/4
     .2666666667
(2*1*1+2*1*1+1*1
*2)/5/3/4
```

```
(3*2*3+2*2*3+3*1
*3+3*2*1)/5/3/4
             .75
```

D3a $P(\text{een zojuist uit het ei gekomen insect komt in klasse 3 tot 4}) = 0{,}83\cdot 0{,}66\cdot 0{,}41 \approx 0{,}225$.

D3b $P(\text{een zojuist uit het ei gekomen insect doodgaat in klasse 2 tot 3}) = 0{,}83\cdot 0{,}66\cdot(1 - 0{,}41) \approx 0{,}323$.

D3c $P(\text{een zojuist uit het ei gekomen insect minstens 4 maanden oud wordt}) = 0{,}83\cdot 0{,}66\cdot 0{,}41\cdot 0{,}12 \approx 0{,}027$.

D3d $P(\text{een zojuist uit het ei gekomen insect minder dan 4 maanden oud wordt})$

$= 1 - P(\text{een zojuist uit het ei gekomen insect minstens 4 maanden oud wordt}) = 1 - 0{,}83\cdot 0{,}66\cdot 0{,}41\cdot 0{,}12 \approx 0{,}973$.

```
0.83*0.66*0.41
         .224598
0.83*0.66*0.59
         .323202
```

```
0.83*0.66*0.41*0
.12
      .02695176
1-Ans
      .97304824
```

D4a $P(r = 2) = P(\underline{\underline{\text{r r }\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}}}) = \binom{7}{2}\cdot P(\text{r r }\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}) = \binom{7}{2}\cdot(\frac{3}{6})^2\cdot(\frac{3}{6})^5 \approx 0{,}164$.

D4b $P(\underline{\underline{\text{r r r r r w w}}}) = \binom{7}{5}\cdot P(\text{r r r r r w w}) = \binom{7}{5}\cdot(\frac{3}{6})^5\cdot(\frac{2}{6})^2 \approx 0{,}073$.

```
7 nCr 2*(3/6)^7
        .1640625
7 nCr 5*(3/6)^5*
(2/6)^2
     .0729166667
```

D4c $P(\bar{b} \geq 6) = P(\bar{b} = 6) + P(\bar{b} = 7) = P(\underline{\underline{\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}\,\text{b}}}) + P(\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}) = \binom{7}{6}\cdot(\frac{5}{6})^6\cdot\frac{1}{6} + (\frac{5}{6})^7 \approx 0{,}670$.

D4d $P(r \leq 5) = 1 - P(r = 6) - P(r = 7) = P(\underline{\underline{\text{r r r r r r }\bar{\text{r}}}}) - P(\text{r r r r r r r}) = 1 - \binom{7}{6}\cdot(\frac{3}{6})^6\cdot\frac{3}{6} - (\frac{3}{6})^7 \approx 0{,}938$.

```
7 nCr 6*(5/6)^6*
1/6+(5/6)^7
     .6697959534
1-7 nCr 6*(3/6)^
7-(3/6)^7
           .9375
```

D5a $P(\text{twee knikkers pakken}) = P(\text{eerst blauw en dan pas groen}) = P(\text{b g}) = \frac{5}{12}\cdot\frac{7}{11} \approx 0{,}265$.

D5b $P(\text{vijf knikkers pakken}) = P(\text{b b b b g}) = \frac{5}{12}\cdot\frac{4}{11}\cdot\frac{3}{10}\cdot\frac{2}{9}\cdot\frac{7}{8} \approx 0{,}009$.

```
5*7/12/11
     .2651515152
5*4*3*2*7/12/11/
10/9/8
     .0088383838
```

D6a $P(som = 4) = P(\underline{\underline{1\,1\,2}}) = \binom{3}{1}\cdot\frac{1}{6}\cdot\frac{1}{6}\cdot\frac{1}{6} = \frac{1}{72} \Rightarrow P(\text{twee van de 20 keer } som = 4) = \binom{20}{2}\cdot(\frac{1}{72})^2\cdot(\frac{71}{72})^{18} \approx 0{,}028$.

```
3 nCr 1*(1/6)^3▸
Frac
            1/72
20 nCr 2*(1/72)²
*(71/72)^18
     .0284940347
```

D6b $P(som \geq 17) = P(som = 17) + P(som = 18) = P(\underline{\underline{6\,6\,5}}) + P(6\,6\,6) = \binom{3}{2}\cdot\frac{1}{6}\cdot\frac{1}{6}\cdot\frac{1}{6} + (\frac{1}{6})^3 = \frac{1}{54}$.

$P(\text{één van de 10 keer } som \geq 17) = \binom{10}{1}\cdot\frac{1}{54}\cdot(\frac{53}{54})^9 \approx 0{,}157$.

```
3 nCr 2*(1/6)^3+
(1/6)^3▸Frac
            1/54
10 nCr 1*1/54*(5
3/54)^9
     .1565111304
```

D6c $P(som = 17) = P(\underline{\underline{6\,6\,5}}) = \binom{3}{2}\cdot\frac{1}{6}\cdot\frac{1}{6}\cdot\frac{1}{6} = \frac{1}{72}$.

```
3 nCr 2*(1/6)^3▸
Frac
            1/72
```

$P(\text{minstens één van de } n \text{ keer } som = 17) = 1 - P(\text{geen van de } n \text{ keer } som = 17) = 1 - P(\overline{17}\;\overline{17}\;...\;\overline{17}) = 1 - (\frac{71}{72})^n > 0{,}4$.

Bladeren in de tabel $\Rightarrow n \geq 37 \Rightarrow$ Jeroen moet minstens 37 keer met drie dobbelstenen gooien.

```
Plot1 Plot2 Plot3
\Y1=1-(71/72)^X
\Y2=0.4
\Y3=
```

X	Y1	Y2
33	.36969	.4
34	.37845	.4
35	.38708	.4
36	.39559	.4
37	.40399	.4
38	.41226	.4
39	.42043	.4

X=37

D7a $P(\text{wedstrijd duurt vier partijen}) = P(\underline{\underline{\text{C C J}}}\text{ C}) + P(\underline{\underline{\text{C J J}}}\text{ J}) = \binom{3}{2}\cdot 0{,}7^2\cdot 0{,}3\cdot 0{,}7 + \binom{3}{1}\cdot 0{,}7\cdot 0{,}3^2\cdot 0{,}3 \approx 0{,}365$.

```
3 nCr 2*0.7^3*0.
3+3 nCr 1*0.7*0.
3^3
           .3654
```

D7b $P(\text{Cees wint}) = P(\text{C C C}) + P(\underline{\underline{\text{C C J}}}\text{ C}) + P(\underline{\underline{\text{C C J J}}}\text{ C}) = 0{,}7^3 + \binom{3}{2}\cdot 0{,}7^2\cdot 0{,}3\cdot 0{,}7 + \binom{4}{2}\cdot 0{,}7^2\cdot 0{,}3^2\cdot 0{,}7 \approx 0{,}837$.

```
0.7^3+3 nCr 2*0.
7^3*0.3+4 nCr 2*
0.7^3*0.3^2
          .83692
```

D8a $P(vrouwen = 3) = P(\underline{\underline{\text{v v v m m}}}) = \dfrac{\binom{7}{3}\cdot\binom{9}{2}}{\binom{16}{5}} \approx 0{,}288$.

```
7 nCr 3*9 nCr 2/
16 nCr 5
     .2884615385
```

D8b $P(vrouwen = 3) = P(\underline{\underline{\text{v v v m m}}}) = \binom{5}{3}\cdot P(\text{v v v m m}) = \binom{5}{3}\cdot(\frac{7}{16})^3\cdot(\frac{9}{16})^2 \approx 0{,}265$.

```
5 nCr 3*(7/16)^3
*(9/16)²
     .2649593353
```

D9a $P(\text{"hoog of middelbaar"} = 9) = P(\text{s s s s s s s s s}) = 0{,}74^9 \approx 0{,}067$.

```
0.74^9
     .0665404108
```

D9b $P(hoog = 2) = P(\underline{\underline{\text{h h }\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}}}) = \binom{9}{2}\cdot P(\text{h h }\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}) = \binom{9}{2}\cdot 0{,}45^2\cdot 0{,}55^7 \approx 0{,}111$.

```
9 nCr 2*0.45²*0.
55^7
     .1109855286
```

D9c $P(\mathit{hoog}=5 \text{ én } \mathit{middelbaar}=4)=P(\underline{\underline{\text{hhhhhmmmm}}})=\binom{9}{5}\cdot P(\text{hhhhhmmmm})=\binom{9}{5}\cdot 0{,}45^5\cdot 0{,}29^4\approx 0{,}016.$

```
9 nCr 5*0.45^5*0
.29^4
        .0164446678
```

D9d $P(\mathit{middelbaar}\le 2)=P(\mathit{middelbaar}=0)+P(\mathit{middelbaar}=1)+P(\mathit{middelbaar}=2)$

$=P(\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m})+P(\underline{\underline{m\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}}})+P(\underline{\underline{m\,m\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}\,\bar{m}}})$

$=0{,}71^9+\binom{9}{1}\cdot 0{,}29\cdot 0{,}71^8+\binom{9}{2}\cdot 0{,}29^2\cdot 0{,}71^7\approx 0{,}490.$

```
0.71^9+9 nCr 1*0
.29*0.71^8+9 nCr
 2*0.29²*0.71^7
        .4897540303
```

D10a $P(X=10)=\frac{5}{36}$ (zie het linker rooster hiernaast).

$P(X\le 8)=P(X=6)+P(X=7)+P(X=8)=\frac{6}{36}=\frac{1}{6}.$

$P(Y>0)=1-P(Y=0)=1-\frac{6}{36}=\frac{30}{36}=\frac{5}{6}$ (zie het rechter rooster).

D10b $P(X=6\,|\,Y=1)=\frac{X=6 \text{ én } Y=1}{Y=1}=\frac{0}{10}=0$ en $P(X=6)=\frac{1}{36}\neq 0.$

Dus X en Y zijn (niet on)afhankelijk.

8	11	12	13	14	15	16
7	10	11	12	13	14	15
6	9	10	11	12	13	14
5	8	9	10	11	12	13
4	7	8	9	10	11	12
3	6	7	8	9	10	11
x	**3**	**4**	**5**	**6**	**7**	**8**

8	5	4	3	2	1	0
7	4	3	2	1	0	1
6	3	2	1	0	1	2
5	2	1	0	1	2	3
4	1	0	1	2	3	4
3	0	1	2	3	4	5
y	**3**	**4**	**5**	**6**	**7**	**8**

Gemengde opgaven 6. Kansrekening

G14a $P(\underline{\underline{\text{aaak}}})=P(\text{aaak})+P(\text{aaka})+P(\text{akaa})+P(\text{kaaa})=0+0+\frac{5}{15}\cdot\frac{2}{15}\cdot\frac{2}{15}\cdot\frac{5}{15}+\frac{3}{15}\cdot\frac{2}{15}\cdot\frac{2}{15}\cdot\frac{5}{15}\approx 0{,}003.$

G14b $P(\text{vier gelijke})=P(\text{aaaa})+P(\text{pppp})+P(\text{bbbb})+P(\text{ki ki ki ki})$

$=\frac{5}{15}\cdot\frac{2}{15}\cdot\frac{2}{15}\cdot\frac{5}{15}+\frac{3}{15}\cdot\frac{4}{15}\cdot\frac{4}{15}\cdot\frac{3}{15}+\frac{1}{15}\cdot\frac{5}{15}\cdot\frac{5}{15}\cdot\frac{1}{15}+\frac{3}{15}\cdot\frac{2}{15}\cdot\frac{4}{15}\cdot\frac{6}{15}\approx 0{,}008.$

```
(5*2*2*5+3*2*2*5
)/15^4
        .0031604938
(5*2*2*5+3*4*4*3
+1*5*5*1+3*2*4*6
)/15^4
        .0081580247
```

G14c $P(\underline{\underline{\text{b}\,\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}}})=P(\text{b}\,\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}})+P(\bar{\text{b}}\,\text{b}\,\bar{\text{b}}\,\bar{\text{b}})+P(\bar{\text{b}}\,\bar{\text{b}}\,\text{b}\,\bar{\text{b}})+P(\bar{\text{b}}\,\bar{\text{b}}\,\bar{\text{b}}\,\text{b})$

$=\frac{1}{15}\cdot\frac{10}{15}\cdot\frac{10}{15}\cdot\frac{14}{15}+\frac{14}{15}\cdot\frac{5}{15}\cdot\frac{10}{15}\cdot\frac{14}{15}+\frac{14}{15}\cdot\frac{10}{15}\cdot\frac{5}{15}\cdot\frac{14}{15}+\frac{14}{15}\cdot\frac{10}{15}\cdot\frac{10}{15}\cdot\frac{1}{15}\approx 0{,}442.$

G14d $P(\overline{\text{ki}}\,\overline{\text{ki}}\,\overline{\text{ki}}\,\overline{\text{ki}})=\frac{12}{15}\cdot\frac{13}{15}\cdot\frac{11}{15}\cdot\frac{9}{15}\approx 0{,}305.$

```
(1*10*10*14+14*5
*10*14+14*10*5*1
4+14*10*10*1)/15
^4
        .4424691358
12*13*11*9/15^4
        .3050666667
```

G15a $P(\text{w})=1-0{,}3-0{,}5=0{,}2\Rightarrow P(\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}}\,\bar{\text{w}})=0{,}8^{10}\approx 0{,}107.$

G15b $P(\underline{\underline{\text{ppppppwwww}}})=\binom{10}{6}\cdot P(\text{ppppppwwww})=\binom{10}{6}\cdot 0{,}5^6\cdot 0{,}2^4\approx 0{,}005.$

```
0.8^10
        .1073741824
10 nCr 6*0.5^6*0
.2^4
             .00525
```

G15c $P(\mathit{rood}\ge 2)=1-P(\mathit{rood}<2)=1-P(\mathit{rood}=0)-P(\mathit{rood}=1)$

$=1-P(\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}})-P(\underline{\underline{\text{r}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}\,\bar{\text{r}}}})=1-0{,}7^{10}-\binom{10}{1}\cdot 0{,}3\cdot 0{,}7^9\approx 0{,}851.$

G15d $P(\underline{\underline{\text{ppppp}\,\bar{\text{p}}\,\bar{\text{p}}\,\bar{\text{p}}\,\bar{\text{p}}\,\bar{\text{p}}}})=\binom{10}{5}\cdot P(\text{ppppp}\,\bar{\text{p}}\,\bar{\text{p}}\,\bar{\text{p}}\,\bar{\text{p}}\,\bar{\text{p}})=\binom{10}{5}\cdot 0{,}5^5\cdot 0{,}5^5\approx 0{,}246.$

```
1-0.7^10-10 nCr
1*0.3*0.7^9
        .8506916541
10 nCr 5*0.5^10
         .24609375
```

G16a $P(\text{rrr})=\frac{5}{9}\cdot\frac{7}{11}\cdot\frac{9}{13}\approx 0{,}245.$

G16b $P(\mathit{rood}>\mathit{wit})=P(\text{rrr})+P(\underline{\underline{\text{rrw}}})=P(\text{rrr})+P(\text{rrw})+P(\text{rwr})+P(\text{wrr})$

$=\frac{5}{9}\cdot\frac{7}{11}\cdot\frac{9}{13}+\frac{5}{9}\cdot\frac{7}{11}\cdot\frac{4}{13}+\frac{5}{9}\cdot\frac{4}{11}\cdot\frac{7}{13}+\frac{4}{9}\cdot\frac{5}{11}\cdot\frac{7}{13}\approx 0{,}571.$

```
5*7*9/9/11/13
        .2447552448
(5*7*9+5*7*4+5*4
*7+4*5*7)/9/11/1
3
        .5710955711
```

G17a $P(X=100)=P(3\,3\,3)=\frac{1}{4}\cdot\frac{1}{5}\cdot\frac{1}{6}=\frac{1}{120}.$

G17b $P(X=20)=P(4\,4\,4)=\frac{1}{4}\cdot\frac{2}{5}\cdot\frac{2}{6}=\frac{4}{120}=\frac{1}{30}.$

$P(X=5)=P(5\,5\,5)=\frac{2}{4}\cdot\frac{2}{5}\cdot\frac{3}{6}=\frac{12}{120}=\frac{1}{10}.$

```
1/4/5/6▸Frac
              1/120
4/4/5/6▸Frac
               1/30
12/4/5/6▸Frac
               1/10
```

Kansverdeling van toevalsvariabele X.

x	0	5	20	100
$P(X=x)$	$\frac{103}{120}$	$\frac{12}{120}$	$\frac{4}{120}$	$\frac{1}{120}$

$P(X=0)=1-P(X=100)-P(X=20)-P(X=5)=1-\frac{1}{120}-\frac{4}{120}-\frac{12}{120}=1-\frac{17}{120}=\frac{103}{120}.$

G17c $P(Y=10)=P(\underline{\underline{3\,3\,4}})=P(3\,3\,4)+P(3\,4\,3)+P(4\,3\,3)=\frac{1}{4}\cdot\frac{1}{5}\cdot\frac{2}{6}+\frac{1}{4}\cdot\frac{2}{5}\cdot\frac{1}{6}+\frac{1}{4}\cdot\frac{1}{5}\cdot\frac{1}{6}=\frac{2+2+1}{120}=\frac{5}{120}=\frac{1}{24}.$

G17d $P(\underline{\underline{3\,3\,\bar{3}}})=P(3\,3\,\bar{3})+P(3\,\bar{3}\,3)+P(\bar{3}\,3\,3)=\frac{1}{4}\cdot\frac{1}{5}\cdot\frac{5}{6}+\frac{1}{4}\cdot\frac{4}{5}\cdot\frac{1}{6}+\frac{3}{4}\cdot\frac{1}{5}\cdot\frac{1}{6}=\frac{5+4+3}{120}=\frac{12}{120}=\frac{1}{10}.$

$P(\underline{\underline{3\,3\,\bar{3}}}\ \underline{\underline{3\,3\,\bar{3}}}\ \underline{\underline{3\,3\,\bar{3}}}\ \underline{\underline{3\,3\,\bar{3}}})=(\frac{1}{10})^4=0{,}0001.$

G17e $P(\text{hoofdprijs})=P(\text{h})=P(X=100)=\frac{1}{120}$ (zie G17a) $\Rightarrow P(\bar{\text{h}})=\frac{119}{120}.$

$P(\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\text{h})+P(\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\text{h})=(\frac{119}{120})^7\cdot\frac{1}{120}+(\frac{119}{120})^8\cdot\frac{1}{120}\approx 0{,}016.$

```
(119/120)^7*1/12
0+(119/120)^8*1/
120
        .0156529218
```

```
Plot1 Plot2 Plot3
\Y1■1-(119/120)^
X
\Y2■0.3
\Y3=
\Y4=
\Y5=
\Y6=
```

```
  X    | Y1     | Y2
  40   | .28447 | .3
  41   | .29043 | .3
  42   | .29634 | .3
  43   | .30221 | .3
  44   | .30802 | .3
  45   | .31379 | .3
  46   | .31951 | .3
Y1=.302208363503
```

G17f $P(\text{minstens één van de } n \text{ keer spelen de hoofdprijs})=1-P(n \text{ keer niet de hoofdprijs})=1-P(\bar{\text{h}}\,\bar{\text{h}}\,\bar{\text{h}}\,\ldots\,\bar{\text{h}})=1-(\frac{119}{120})^n>0{,}3.$

Bladeren in de tabel geeft $n\ge 43\Rightarrow$ Jantine moet minstens 43 keer spelen.

G18a $P(\underline{\underline{vvvvvvvvvv\bar{v}\bar{v}\bar{v}}}) = \binom{13}{10} \cdot P(vvvvvvvvvv\bar{v}\bar{v}\bar{v}) = \binom{13}{10} \cdot 0{,}68^{10} \cdot 0{,}32^3 \approx 0{,}198.$

```
13 nCr 10*0.68^1
0*0.32^3
      .1981094057
```

G18b $P(h \geq 3) = 1 - P(h < 3) = 1 - P(h = 0) - P(h = 1) - P(h = 2) = 1 - P(\bar{h}\bar{h}\bar{h}\ldots\bar{h}) - P(\underline{\underline{h\bar{h}\bar{h}\ldots\bar{h}}}) - P(\underline{\underline{hh\bar{h}\ldots\bar{h}}})$

$= 1 - P(\bar{h}\bar{h}\bar{h}\ldots\bar{h}) - \binom{13}{1} \cdot P(h\bar{h}\bar{h}\ldots\bar{h}) - \binom{13}{2} \cdot P(hh\bar{h}\ldots\bar{h}) = 1 - 0{,}81^{13} - \binom{13}{1} \cdot 0{,}19 \cdot 0{,}81^{12} - \binom{13}{2} \cdot 0{,}19^2 \cdot 0{,}81^{11} \approx 0{,}461.$

```
1-0.81^13-13 nCr
 1*0.19*0.81^12-
13 nCr 2*0.19²*0
.81^11
      .4610742761
```

G18c $P(\underline{\underline{vvvvvvvvvhhhh}}) = \binom{13}{9} \cdot P(vvvvvvvvvhhhh) = \binom{13}{9} \cdot 0{,}68^9 \cdot 0{,}19^4 \approx 0{,}029.$

```
13 nCr 9*0.68^9*
0.19^4
      .0289668093
```

G19a $P(\text{twee of drie goed}) = P(\underline{\underline{gg\bar{g}\bar{g}\ldots\bar{g}}}) + P(\underline{\underline{ggg\bar{g}\ldots\bar{g}}}) = \binom{18}{2} \cdot P(gg\bar{g}\bar{g}\ldots\bar{g}) + \binom{18}{3} \cdot P(ggg\bar{g}\ldots\bar{g})$

$= \binom{18}{2} \cdot 0{,}25^2 \cdot 0{,}75^{16} + \binom{18}{3} \cdot 0{,}25^3 \cdot 0{,}75^{15} \approx 0{,}266.$

```
18 nCr 2*0.25²*0
.75^16+18 nCr 3*
0.25^3*0.75^15
      .2662251998
```

G19b Van de resterende 13 vragen dus minder dan 3 goed gokken (5 kan hij er zonder te gokken goed invullen).

$P(g < 3) = P(g = 0) + P(g = 1) + P(g = 2) = 0{,}75^{13} + \binom{13}{1} \cdot 0{,}25 \cdot 0{,}75^{12} + \binom{13}{2} \cdot 0{,}25^2 \cdot 0{,}75^{11} \approx 0{,}333.$

```
0.75^13+13 nCr 1
*0.25*0.75^12+13
 nCr 2*0.25²*0.7
5^11
      .3326016963
```

G19c Van de resterende 8 vragen er dus nog maar hoogstens 2 goed raden.

$P(g \leq 2) = P(g = 0) + P(g = 1) + P(g = 2) = 0{,}75^8 + \binom{8}{1} \cdot 0{,}25 \cdot 0{,}75^7 + \binom{8}{2} \cdot 0{,}25^2 \cdot 0{,}75^6 \approx 0{,}679.$

```
0.75^8+8 nCr 1*0
.25*0.75^7+8 nCr
 2*0.25²*0.75^6
      .6785430908
```

G20a $P(\underline{\underline{rrrbbb}}) = \binom{6}{3} \cdot (\frac{5}{12})^3 \cdot (\frac{3}{12})^3 \approx 0{,}023.$

```
6 nCr 3*(5/12)^3
*(3/12)^3
      .0226056134
```

G20b $P(\text{succes}) = P(s) = P(\bar{r}\bar{r}\bar{r}) = \dfrac{\binom{7}{3}}{\binom{12}{3}} = \dfrac{7}{44} \Rightarrow P(\underline{\underline{ss\bar{s}\bar{s}\bar{s}\bar{s}}}) = \binom{6}{2} \cdot (\frac{7}{44})^2 \cdot (\frac{37}{44})^4 \approx 0{,}190.$

```
7 nCr 3/12 nCr 3
▸Frac
             7/44
6 nCr 2*(7/44)²*
(37/44)^4
      .1898358261
```

G20c $P(\underline{\underline{wrrr}}) + P(\underline{\underline{wwbr}}) = \dfrac{\binom{4}{1} \cdot \binom{5}{3}}{\binom{12}{4}} + \dfrac{\binom{4}{2} \cdot \binom{3}{1} \cdot \binom{5}{1}}{\binom{12}{4}} \approx 0{,}263.$

```
4 nCr 1*5 nCr 3+
4 nCr 2*3 nCr 1*
5 nCr 1
              130
Ans/12 nCr 4
      .2626262626
```

G21a Ja, als de een bloedgroep A heeft en de ander bloedgroep B.

G21b $P(\text{dezelfde bloedgroep}) = P(0\,0) + P(A\,A) + P(B\,B) + P(AB\,AB) = 0{,}46^2 + 0{,}43^2 + 0{,}08^2 + 0{,}03^2 = 0{,}4038.$

G21c $P(\text{"0"} \geq 1) = 1 - (\text{"0"} < 1) = 1 - (\text{"0"} = 0) = 1 - P(\bar{0}\bar{0}\bar{0}\bar{0}\ldots\bar{0}) = 1 - 0{,}54^{12} \approx 0{,}9994.$

```
0.46²+0.43²+0.08
²+0.03²
            .4038
1-0.46
              .54
1-0.54^12
      .9993852124
```

G21d $P(\text{dezelfde resusfactor}) = P(+\ +) + P(-\ -) = 0{,}85^2 + 0{,}15^2 = 0{,}745.$
$P(\text{dezelfde bloedgroep}) = 0{,}4038$ (zie G21b).
$P(\text{hetzelfde bloedtype}) = P(\text{dezelfde resusfactor en dezelfde bloedgroep}) = 0{,}745 \cdot 0{,}4038 \approx 0{,}3.$

```
0.85²+0.15²
             .745
Ans*0.4038
          .300831
```

G22a Nadat de eerste kaart is gedraaid, liggen er nog 15 met het plaatje naar beneden.
De kans dat de tweede kaart hetzelfde plaatje heeft is dus $\frac{1}{15}$.

G22b $P(\text{eerste twee kaarten pakken}) = \frac{1}{7}$. (na de eerste kaart liggen er nog 7 met het plaatje naar beneden)
$P(\text{volgende twee kaarten pakken}) = \frac{1}{5}$. Enzovoort.
De gevraagde kans is $\frac{1}{7} \cdot \frac{1}{5} \cdot \frac{1}{3} \cdot 1 = \frac{1}{105}$.

```
1/7*1/5*1/3▸Frac
            1/105
```

G22c Het viertal plaatjes op de niet omgedraaide kaarten is ● ■ ▲ ▲

er zijn 4 mogelijkheden voor de cirkel
er zijn dan nog drie mogelijheden voor het vierkant
de driehoeken liggen dan vast
$\Rightarrow$ aantal $= 4 \cdot 3 = 12.$

OF aantal $= \frac{4!}{2!} = 12.$ OF aantal $= \binom{4}{2} \cdot \binom{2}{1} \cdot \binom{1}{1} = 12.$

```
4*3
               12
4!/2!
               12
4 nCr 2*2 nCr 1*
1 nCr 1
               12
```

```
4 nCr 1*3 nCr 1*
2 nCr 2
               12
4 nCr 1*3 nCr 2*
1 nCr 1
               12
```

G22d • strategie 1: $P(\text{succes}) = P(\text{de tweede kaart is een vierkant}) = \frac{1}{3}$.

• strategie 2: $P(\text{succes}) = P(\text{de eerste kaart is een vierkant}) + P(\text{eerste en tweede is een driehoek}) = \frac{1}{3} + \frac{2}{3} \cdot \frac{1}{2} = \frac{2}{3}$.

```
1/3+2/3*1/2▸Frac
              2/3
```