1 Som 15 kan met $\underline{\underline{663}}$ (op $\frac{3!}{2!} = \binom{3}{2} = 3$ manieren), $\underline{\underline{654}}$ (op $3! = 6$ manieren) en 555 (op 1 manier).
Dus totaal $3 + 6 + 1 = 10$ gunstige uitkomsten.

```
3 nCr 2+3!+1
            10
```

Dubbel onderstreept betekent: "niet alleen" in de genoteerde volgorde

+	1	2	3	4	5	6
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

2a $P(\text{som} \neq 5) = 1 - P(\text{som} = 5) = 1 - \frac{4}{36} = \frac{32}{36} (= \frac{8}{9})$.

2c $P(\text{som} \geq 10) = \frac{6}{36} (= \frac{1}{6})$.

2b $P(\text{som} \geq 4) = 1 - P(\text{som} < 4) = 1 - \frac{3}{36} = \frac{33}{36} (= \frac{11}{12})$.

2d $P(\text{som} \leq 10) = 1 - P(\text{som} > 10) = 1 - \frac{3}{36} = \frac{33}{36} (= \frac{11}{12})$.

3a $P(\text{som} \leq 22) = 1 - P(\text{som} > 22) = 1 - P(\text{som} = 23 \text{ of som} = 24) = 1 - \frac{5}{1296} = \frac{1291}{1296}$. (zie de uitleg hieronder)
Som 23 kan met $\underline{\underline{6665}}$ en som 24 met 6666. Dus totaal $\binom{4}{3} + 1 = 4 + 1 = 5$ gunstige uitkomsten.
Het aantal mogelijke uitkomsten met vier dobbelstenen is $6 \times 6 \times 6 \times 6 = 1296$.

```
4 nCr 3+1
             5
6^4
          1296
1-5/1296▸Frac
     1291/1296
```

3b $P(\text{som} \geq 7) = 1 - P(\text{som} \leq 6) = 1 - P(\text{som} = 4 \text{ of som} = 5 \text{ of som} = 6) = 1 - \frac{15}{1296} = \frac{1281}{1296}$ (eventueel $= \frac{427}{432}$).
Som 4 met 1111, som 5 met $\underline{\underline{1112}}$ en som 6 met $\underline{\underline{1122}}$ en $\underline{\underline{1113}}$. Dus totaal $1 + \binom{4}{3} + \binom{4}{2} + \binom{4}{3} = 15$ gunstige uitkomsten.

```
1+4 nCr 3+4 nCr
2+4 nCr 3
            15
1-15/6^4▸Frac
       427/432
```

4a $P(\text{minstens één prijs}) = 1 - P(\text{geen prijs}) = 1 - P(0 \text{ euro}) = 1 - P(3 \times €0) = 1 - \frac{\binom{43}{3}}{\binom{50}{3}} \approx 0{,}370$.

```
1-43 nCr 3/50 nC
r 3
  .3703571429
```

4b $P(100 \text{ euro}) = P(1 \times €100) + P(2 \times €50) = \frac{\binom{1}{1} \cdot \binom{43}{2}}{\binom{50}{3}} + \frac{\binom{2}{2} \cdot \binom{43}{1}}{\binom{50}{3}} \approx 0{,}048$.

```
1*43 nCr 2+1*43
nCr 1
           946
Ans/50 nCr 3
   .0482653061
```

4c $P(\text{minstens 30 euro}) = 1 - P(\text{minder dan 30 euro}) = 1 - (P(3 \times €0) + P(1 \times €10) + P(2 \times €10))$
$= 1 - \left(\frac{\binom{43}{3}}{\binom{50}{3}} + \frac{\binom{4}{1} \cdot \binom{43}{2}}{\binom{50}{3}} + \frac{\binom{4}{2} \cdot \binom{43}{1}}{\binom{50}{3}} \right) \approx 0{,}173$.

```
43 nCr 3+4*43 nC
r 2+4 nCr 2*43
         16211
1-Ans/50 nCr 3
   .1729081633
```

5 $P(\text{afkeuren}) = 1 - P(\text{goedkeuren}) = 1 - \frac{\binom{37}{3}}{\binom{40}{3}} \approx 0{,}214$.

```
1-37 nCr 3/40 nC
r 3
    .213562753
```

6a $P(\text{geen uit Californië}) = \frac{\binom{98}{8}}{\binom{100}{8}} \approx 0{,}846$.

6b $P(\text{één uit Arizona en één uit Florida}) = \frac{\binom{2}{1} \cdot \binom{2}{1} \cdot \binom{96}{6}}{\binom{100}{8}} \approx 0{,}020$.

```
98 nCr 8/100 nCr
8
   .8456565657
2 nCr 1*2 nCr 1*
96 nCr 6/100 nCr
8
   .0199271061
```

7a $P(\text{louter meisjes}) = \frac{\binom{8}{4}}{\binom{12}{4}} \approx 0{,}141$.

```
8 nCr 4/12 nCr 4
   .1414141414
```

	meisje	jongen	totaal
vwo	3	2	5
niet vwo	5	2	7
totaal	8	4	12

7b $P(\text{precies 2 op het vwo}) = \frac{\binom{5}{2} \cdot \binom{7}{2}}{\binom{12}{4}} \approx 0{,}424$.

7c $P(\text{precies 1 jongen niet op het vwo}) = \frac{\binom{2}{1} \cdot \binom{10}{3}}{\binom{12}{4}} \approx 0{,}485$.

```
5 nCr 2*7 nCr 2/
12 nCr 4
   .4242424242
2 nCr 1*10 nCr 3
/12 nCr 4
   .4848484848
```

8a $P(\text{nummer 14 bij de eerste drie}) = \frac{\binom{1}{1} \cdot \binom{15}{2}}{\binom{16}{3}} \approx 0{,}188$.

8c $P(\text{nummers 3, 7, 8 en 9 bij de eerste acht}) = \frac{\binom{4}{4} \cdot \binom{12}{4}}{\binom{16}{8}} \approx 0{,}038$.

```
1 nCr 1*15 nCr 2
/16 nCr 3
         .1875
3 nCr 3/16 nCr 3
   .0017857143
```

8b $P(\text{nummers 1, 2 en 3 bij de laatste drie}) = \frac{\binom{3}{3}}{\binom{16}{3}} \approx 0{,}002$.

```
4 nCr 4*12 nCr 4
/16 nCr 8
   .0384615385
```

9a $P(\text{minstens één volleyballer moet wachten}) = 1 - P(\text{geen volleyballer moet wachten}) = 1 - \frac{\binom{46}{6}}{\binom{54}{6}} \approx 0{,}637$.

```
1-46 nCr 6/54 nC
r 6
   .6373268611
```

9b $P(\text{de heer Aalderink en zijn secretaresse hoeven niet te wachten}) = \frac{\binom{52}{6}}{\binom{54}{6}} \approx 0{,}788$.

```
52 nCr 6/54 nCr
6
   .7882599581
```

10a $P(\text{alle zes getallen kleiner dan 20}) = \dfrac{\binom{19}{6}}{\binom{44}{6}} \approx 0{,}004.$

```
19 nCr 6/44 nCr
6
        .0038435756
1 nCr 1*39 nCr 5
/44 nCr 6
        .0815629351
```

10b $P(\underline{\text{40 en vijf getallen kleiner dan 40}}) = \dfrac{\binom{1}{1}\cdot\binom{39}{5}}{\binom{44}{6}} \approx 0{,}082.$

10c $P(\text{derde prijs}) = \dfrac{\binom{6}{4}\cdot\binom{38}{2}}{\binom{44}{6}} \approx 0{,}001.$

10d $P(\text{vierde prijs}) = \dfrac{\binom{6}{3}\cdot\binom{1}{1}\cdot\binom{37}{2}}{\binom{44}{6}} \approx 0{,}002.$

```
6 nCr 4*38 nCr 2
/44 nCr 6
        .0014938266
6 nCr 3*1 nCr 1*
37 nCr 2/44 nCr
6
        .0018869389
```

11a $P(\text{rrw}) = \frac{2}{4}\cdot\frac{2}{4}\cdot\frac{1}{4} = 0{,}0625 \approx 0{,}063.$

```
2/4*2/4*1/4
              .0625
```

11b $P(\underline{\text{rrw}}) = \binom{3}{2}\cdot\frac{2}{4}\cdot\frac{2}{4}\cdot\frac{1}{4} = 0{,}1875 \approx 0{,}188.$

```
3 nCr 2*2/4*2/4*
1/4
              .1875
```

12a $P(33) = \frac{1}{4}\cdot\frac{1}{5} = 0{,}05.$

12b $P(\bar{1}\bar{1}) = \frac{3}{4}\cdot\frac{3}{5} = 0{,}45.$

```
1/4*1/5
                .05
3/4*3/5
                .45
```

12c $P(\underline{2\bar{2}}) = P(2\bar{2}) + P(\bar{2}2) = \frac{2}{4}\cdot\frac{3}{5} + \frac{2}{4}\cdot\frac{2}{5} = 0{,}5.$

12d $P(\text{minstens één 2}) = 1 - P(\bar{2}\bar{2}) = 1 - \frac{2}{4}\cdot\frac{3}{5} = 0{,}7.$

```
2/4*3/5+2/4*2/5
                 .5
1-2/4*3/5
                 .7
```

13a $P(\underline{2\bar{2}\bar{2}\bar{2}\bar{2}\bar{2}\bar{2}\bar{2}}) = \binom{8}{1}\cdot\frac{2}{5}\cdot\left(\frac{3}{5}\right)^7 \approx 0{,}090.$

13b $P(\text{minstens een 1}) = 1 - P(\bar{1}\bar{1}\bar{1}\bar{1}\bar{1}\bar{1}\bar{1}\bar{1}) = 1 - \left(\frac{3}{5}\right)^8 \approx 0{,}983.$

```
8 nCr 1*2/5*(3/5
)^7
          .08957952
1-(3/5)^8
          .98320384
```

13c $P(\underline{11111333}) = \binom{8}{5}\cdot\left(\frac{2}{5}\right)^5\cdot\left(\frac{1}{5}\right)^3 \approx 0{,}005.$

13d $P(\underline{11113222}) = \binom{8}{4}\cdot\binom{4}{1}\cdot\left(\frac{2}{5}\right)^4\cdot\frac{1}{5}\cdot\left(\frac{2}{5}\right)^3 \approx 0{,}092.$

```
8 nCr 5*(2/5)^5*
(1/5)^3
          .00458752
8 nCr 4*4 nCr 1*
(2/5)^4*1/5*(2/5
)^3
           .0917504
```

14a $P(\bar{v}\bar{v}\bar{v}\bar{v}\bar{v}) = \left(\frac{4}{5}\right)^5 \approx 0{,}328.$

```
(4/5)^5
             .32768
```

14b $P(\text{minstens één v}) = 1 - P(\text{geen v}) = 1 - P(\bar{v}\bar{v}\bar{v}\bar{v}\bar{v}\bar{v}) = 1 - \left(\frac{4}{5}\right)^6 \approx 0{,}738.$

```
1-(4/5)^6
            .737856
```

14c $P(\underline{v\bar{v}\bar{v}\bar{v}\bar{v}\bar{v}\bar{v}\bar{v}}) = \binom{8}{1}\cdot\frac{1}{5}\cdot\left(\frac{4}{5}\right)^7 \approx 0{,}336.$

```
8 nCr 1*1/5*(4/5
)^7
          .33554432
```

15 $P(\text{afgekeurd}) = 1 - P(\text{goedgekeurd}) = 1 - P(\text{gggg}) = 1 - 0{,}98\cdot 0{,}70\cdot 0{,}95\cdot 0{,}92 \approx 0{,}400.$

```
1-0.98*0.7*0.95*
0.92
            .400436
```

16a $P(\underline{4\bar{4}\bar{4}}) = \binom{3}{1}\cdot\frac{1}{4}\cdot\left(\frac{3}{4}\right)^2 = \frac{27}{64}.$

```
3 nCr 1*1/4*(3/4
)^2▸Frac
              27/64
```

16b $P(\text{minstens één 2}) = 1 - P(\bar{2}\bar{2}\bar{2}) = 1 - \left(\frac{3}{4}\right)^3 = \frac{37}{64}.$

```
1-(3/4)^3▸Frac
              37/64
```

17a $P(\text{minstens twee slagen}) = 1 - P(\bar{s}\bar{s}\bar{s}\bar{s}\bar{s}\bar{s}\bar{s}\bar{s}) - P(\underline{s\bar{s}\bar{s}\bar{s}\bar{s}\bar{s}\bar{s}\bar{s}}) = 1 - 0{,}78^8 - \binom{8}{1}\cdot 0{,}22\cdot 0{,}78^7 \approx 0{,}554.$

```
1-0.78^8-8 nCr 1
*0.22*0.78^7
        .5538345511
```

17b $P(\text{6 of 7 slagen}) = P(\underline{ssssss\bar{s}\bar{s}\bar{s}\bar{s}\bar{s}\bar{s}}) + P(\underline{sssssss\bar{s}\bar{s}\bar{s}\bar{s}\bar{s}}) = \binom{12}{6}\cdot 0{,}53^6\cdot 0{,}47^6 + \binom{12}{7}\cdot 0{,}53^7\cdot 0{,}47^5 \approx 0{,}434.$

17c $P(\text{hoogstens twee zakken}) = P(\text{ssssssssss}) + P(\underline{\bar{s}sssssssss}) + P(\underline{\bar{s}\bar{s}ssssssss})$
$= 0{,}71^{10} + \binom{10}{1}\cdot 0{,}29\cdot 0{,}71^9 + \binom{10}{2}\cdot 0{,}29^2\cdot 0{,}71^8 \approx 0{,}410.$

```
0.71^10+10 nCr 1
*0.29*0.71^9+10
nCr 2*0.29²*0.71
^8
        .4098985115
```

```
12 nCr 6*0.53^6*
0.47^6+12 nCr 7*
0.53^7*0.47^5
        .4341329198
```

18a $P(\text{drie keer 2, een keer 3 en acht keer iets anders}) = P(\underline{2223aaaaaaaa}) = \binom{12}{3}\cdot\binom{9}{1}\cdot\left(\frac{1}{6}\right)^3\cdot\frac{1}{6}\cdot\left(\frac{4}{6}\right)^8 \approx 0{,}060.$

```
12 nCr 3*9 nCr 1
*(1/6)^4*(4/6)^8
        .0596115091
```

18b $P(\underline{112233445566}) = \binom{12}{2}\cdot\binom{10}{2}\cdot\binom{8}{2}\cdot\binom{6}{2}\cdot\binom{4}{2}\cdot\left(\frac{1}{6}\right)^2\cdot\left(\frac{1}{6}\right)^2\cdot\left(\frac{1}{6}\right)^2\cdot\left(\frac{1}{6}\right)^2\cdot\left(\frac{1}{6}\right)^2\cdot\left(\frac{1}{6}\right)^2 \approx 0{,}003.$

```
12 nCr 2*10 nCr
2*8 nCr 2*6 nCr
2*4 nCr 2*(1/6)^
12
        .0034382859
```

18c $P(\text{???????????e}) = 1^{11}\cdot\frac{1}{6} = \frac{1}{6} \approx 0{,}167.$ (? betekent: de worp maakt niet uit, e staat voor eerste worp)

```
1/6     .1666666667
```

18d $P(\text{vierde keer voor het eerst een 6}) = P(\bar{6}\bar{6}\bar{6}6) = \left(\frac{5}{6}\right)^3\cdot\frac{1}{6} \approx 0{,}096.$

```
(5/6)^3*1/6
        .0964506173
```

18e $P(\text{minstens vijf keer gooien voor de eerste 6}) = P(\text{eerste vier keer geen 6}) = P(\bar{6}\bar{6}\bar{6}\bar{6}) = \left(\frac{5}{6}\right)^4 \approx 0{,}482.$

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

19a $P(\textit{kinderdagverblijf} = 2) = P(\underline{kk\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}}) = \binom{8}{2}\cdot 0{,}14^2\cdot 0{,}86^6 \approx 0{,}222.$

19b $P(\textit{betaalde oppas} \geq 2) = 1 - P(\textit{betaalde oppas} < 2) = 1 - \left(P(\textit{betaalde oppas} = 0) + P(\textit{betaalde oppas} = 1)\right)$
$= 1 - \left(P(\bar{b}\bar{b}\bar{b}\bar{b}\bar{b}\bar{b}\bar{b}\bar{b}) + P(\underline{b\bar{b}\bar{b}\bar{b}\bar{b}\bar{b}\bar{b}\bar{b}})\right) = 1 - \left(0{,}95^8 + \binom{8}{1}\cdot 0{,}05\cdot 0{,}95^7\right) \approx 0{,}057.$

```
8 nCr 2*0.14²*0.
86^6
        .2220264986
1-(0.95^8+8 nCr
1*0.05*0.95^7)
        .0572446503
```

19c $P(\textit{geen oppas} > 6) = P(\textit{geen oppas} = 7) + P(\textit{geen oppas} = 8)$
$= P(\underline{ggggggg\bar{g}}) + P(gggggggg) = \binom{8}{7}\cdot 0{,}74^7\cdot 0{,}26 + 0{,}74^8 \approx 0{,}343.$

5% + 21% = 26% heeft oppas (betaald dan wel onbetaald)

```
8 nCr 7*0.74^7*0
.26+0.74^8
        .3426661037
```

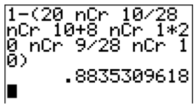
19d $P(\textit{geen opvang} = 6) = P(\underline{\bar{o}\bar{o}\bar{o}\bar{o}\bar{o}\bar{o}oooo}) = \dfrac{\binom{12}{6}\cdot\binom{16}{4}}{\binom{28}{10}} \approx 0{,}128.$

28 − 12 = 16 met kinderopvang (kinderdagverblijf of oppas)

```
12 nCr 6*16 nCr
4/28 nCr 10
        .1281464531
```

19e $P(kinderdagverblijf \geq 2) = 1 - P(kinderdagverblijf < 2) = 1 - \left(P(kinderdagverblijf = 0) + P(kinderdagverblijf = 1)\right)$

$= 1 - \left(P(\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}) + P(\underline{\underline{k\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}\bar{k}}})\right) = 1 - \left(\frac{\binom{20}{10}}{\binom{28}{10}} + \frac{\binom{8}{1}\cdot\binom{20}{9}}{\binom{28}{10}}\right) \approx 0{,}884.$



20a $P(\text{een rode uit I}) = \frac{\text{aantal gunstige uitkomsten}}{\text{aantal mogelijke uitkomsten}}(\text{kansdefinitie van Laplace}) = \frac{\text{aantal rode knikkers in I}}{\text{totaal aantal knikkers in I}} = \frac{a}{10}.$

$P(\text{een zwarte uit I}) = \frac{\text{aantal gunstige uitkomsten}}{\text{aantal mogelijke uitkomsten}}(\text{Laplace}) = \frac{\text{aantal zwarte knikkers in I}}{\text{totaal aantal knikkers in I}} = \frac{10-a}{10}.$

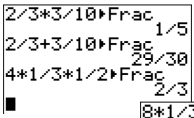
20b $P(\text{een rode uit II}) = \frac{\text{aantal gunstige uitkomsten}}{\text{aantal mogelijke uitkomsten}}(\text{Laplace}) = \frac{\text{aantal rode knikkers in II}}{\text{totaal aantal knikkers in II}} = \frac{b}{8}.$

$P(\text{een zwarte uit II}) = \frac{\text{aantal gunstige uitkomsten}}{\text{aantal mogelijke uitkomsten}}(\text{Laplace}) = \frac{\text{aantal zwarte knikkers in II}}{\text{totaal aantal knikkers in II}} = \frac{8-b}{8}.$

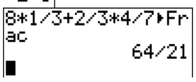
21a $\frac{2}{3}\cdot\frac{3}{10} = \frac{6}{30} = \frac{1}{5}.$

21b $\frac{2}{3}+\frac{3}{10} = \frac{20}{30}+\frac{9}{30} = \frac{29}{30}.$

21c $4\cdot\frac{1}{3}\cdot\frac{1}{2} = \frac{4}{6} = \frac{2}{3}.$



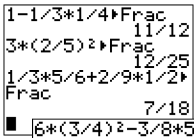
21d $8\cdot\frac{1}{3}+\frac{2}{3}\cdot\frac{4}{7} = \frac{8}{3}+\frac{8}{21} = \frac{56}{21}+\frac{8}{21} = \frac{64}{21}.$



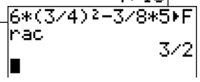
21e $1-\frac{1}{3}\cdot\frac{1}{4} = 1-\frac{1}{12} = \frac{11}{12}.$

21f $3\cdot\left(\frac{2}{5}\right)^2 = 3\cdot\frac{4}{25} = \frac{12}{25}.$

21g $\frac{1}{3}\cdot\frac{5}{6}+\frac{2}{9}\cdot\frac{1}{2} = \frac{5}{18}+\frac{2}{18} = \frac{7}{18}.$



21h $6\cdot\left(\frac{3}{4}\right)^2-\frac{3}{8}\cdot 5 = 6\cdot\frac{9}{16}-\frac{15}{8} = \frac{54}{16}-\frac{30}{16} = \frac{24}{16} = \frac{3}{2}.$



22a $5\cdot\left(\frac{3}{4}\right)^3+3\cdot\left(\frac{1}{4}\right)^3 = 5\cdot\frac{27}{64}+3\cdot\frac{1}{64} = \frac{135}{64}+\frac{3}{64} = \frac{138}{64} = \frac{69}{32}.$

22b $4\cdot\frac{2}{3}\cdot\frac{1}{5}+3\cdot\frac{1}{3}\cdot\frac{2}{5} = \frac{8}{15}+\frac{6}{15} = \frac{14}{15}.$

22c $\left(\frac{3}{4}\right)^2+\frac{5}{8}\cdot\frac{1}{2}+\frac{3}{8} = \frac{9}{16}+\frac{5}{16}+\frac{6}{16} = \frac{20}{16} = \frac{5}{4}.$

22d $\frac{3}{4}\cdot\frac{2}{3}+5\cdot\frac{1}{2}\cdot\frac{1}{12} = \frac{6}{12}+\frac{5}{24} = \frac{12}{24}+\frac{5}{24} = \frac{17}{24}.$

22e $1-\frac{1}{3}\cdot\frac{3}{5}-3\cdot\frac{1}{4}\cdot\frac{1}{3} = 1-\frac{3}{15}-\frac{3}{12} = 1-\frac{1}{5}-\frac{1}{4} = 1-\frac{4}{20}-\frac{5}{20} = \frac{11}{20}.$

22f $\frac{3}{\frac{2}{5}}-2\frac{1}{3}-2\cdot\frac{1}{3} = 3\cdot\frac{5}{2}-\frac{7}{3}-\frac{2}{3} = \frac{15}{2}-\frac{9}{3} = 7\frac{1}{2}-3 = 4\frac{1}{2}.$

23a $\frac{5}{p}+\frac{4}{q} = \frac{5q}{pq}+\frac{4p}{pq} = \frac{4p+5q}{pq}.$

23b $\frac{5}{p}\cdot\frac{4}{q} = \frac{20}{pq}.$

23c $1+\frac{5}{p} = \frac{p}{p}+\frac{5}{p} = \frac{p+5}{p}.$

23d $\frac{p}{3}\cdot\frac{2-p}{5} = \frac{p\cdot(2-p)}{15} = \frac{2p-p^2}{15}.$

23e $\frac{6-p}{\frac{2}{3}} = (6-p)\cdot\frac{3}{2} = \frac{18}{2}-\frac{3}{2}p = 9-\frac{3}{2}p.$

23f $\frac{a-5}{a}\cdot\frac{8-a}{3} = \frac{(a-5)\cdot(8-a)}{3a} = \frac{8a-a^2-40+5a}{3a} = \frac{-a^2+13a-40}{3a}.$

23g $\frac{5}{a}+\frac{7-a}{3} = \frac{15}{3a}+\frac{a\cdot(7-a)}{3a} = \frac{15}{3a}+\frac{7a-a^2}{3a} = \frac{-a^2+7a+15}{3a}.$

23h $3\cdot\frac{5}{n}\cdot\frac{2-n}{n}+\frac{5}{n}\cdot\frac{n-1}{n} = \frac{15\cdot(2-n)}{n^2}+\frac{5\cdot(n-1)}{n^2} = \frac{30-15n+5n-5}{n^2} = \frac{-10n+25}{n^2}.$

24a $\frac{1}{a}+\frac{1}{b} = \frac{b}{ab}+\frac{a}{ab} = \frac{a+b}{ab}.$

24b $\frac{1}{a}+2 = \frac{1}{a}+\frac{2a}{a} = \frac{2a+1}{a}.$

24c $\frac{1}{a}\cdot 2\cdot\frac{b}{4} = \frac{2b}{4a} = \frac{b}{2a}.$

24d $3\cdot\frac{a-3}{5}\cdot\frac{2-a}{a}+2\cdot\frac{(3-a)^2}{5a} = \frac{3\cdot(a-3)\cdot(2-a)}{5a}+\frac{2\cdot(3-a)\cdot(3-a)}{5a} = \frac{3\cdot(2a-a^2-6+3a)}{5a}+\frac{2\cdot(9-3a-3a+a^2)}{5a}$

$= \frac{3\cdot(-a^2+5a-6)}{5a}+\frac{2\cdot(a^2-6a+9)}{5a} = \frac{-3a^2+15a-18}{5a}+\frac{2a^2-12a+18}{5a} = \frac{-a^2+3a}{5a} = \frac{a\cdot(-a+3)}{5\cdot a} = \frac{-a+3}{5}.$

24e $5\cdot\frac{3}{8-a}\cdot\frac{2-a}{a}+\frac{a}{8-a}\cdot\frac{a-2}{a} = \frac{15\cdot(2-a)}{a\cdot(8-a)}+\frac{a\cdot(a-2)}{a\cdot(8-a)} = \frac{30-15a}{8a-a^2}+\frac{a^2-2a}{8a-a^2} = \frac{a^2-17a+30}{8a-a^2}.$

24f $5\cdot\frac{3-a}{a^2}-2\cdot\frac{6-a}{a^2} = \frac{5\cdot(3-a)}{a^2}-\frac{2\cdot(6-a)}{a^2} = \frac{15-5a}{a^2}-\frac{12-2a}{a^2} = \frac{15-5a-(12-2a)}{a^2} = \frac{15-5a-12+2a}{a^2} = \frac{-3a+3}{a^2}.$

25a Als er van de totaal 10 knikkers a rood zijn en de rest zwart, dan zijn er $10-a$ zwart.

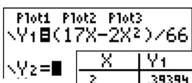
25b $P(\text{een zwarte uit II}) = \frac{\text{aantal gunstige uitkomsten}}{\text{aantal mogelijke uitkomsten}}(\text{Laplace}) = \frac{\text{aantal zwarte knikkers in II}}{\text{totaal aantal knikkers in II}} = \frac{a}{a+6}.$

25c $P(\text{uit beide vazen een zwarte}) = P(\text{een zwarte uit I én een zwarte uit II}) = \frac{10-a}{10}\cdot\frac{a}{a+6} = \frac{(10-a)\cdot a}{10\cdot(a+6)} = \frac{10a-a^2}{10a+60}.$

26a $P(\text{een rode uit I én een rode uit II}) = \frac{x}{11}\cdot\frac{x}{6} = \frac{x^2}{66}.$

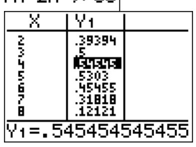
26b $P(\underline{\underline{\text{een rode én een zwarte}}}) = P(\text{rode uit I én zwarte uit II}) + P(\text{zwarte uit I én rode uit II})$

$= \frac{x}{11}\cdot\frac{6-x}{6}+\frac{11-x}{11}\cdot\frac{x}{6} = \frac{x\cdot(6-x)}{66}+\frac{x\cdot(11-x)}{66} = \frac{6x-x^2}{66}+\frac{11x-x^2}{66} = \frac{17x-2x^2}{66}.$



26c $P(\underline{\underline{\text{een rode én een zwarte}}}) = \frac{17x-2x^2}{66}$ (zie 26b) is maximaal (zie TABLE) voor $x = 4$.

$x = 4 \Rightarrow$ in vaas I zijn er 4 rood en 7 zwart en in vaas II zijn er 4 rood, dus 2 zwart.



27a $P(\text{uit beide vazen een rode}) = P(\text{een rode uit I én een rode uit II}) = \frac{5}{a} \cdot \frac{3}{a} = \frac{15}{a^2}$.

27b $P(\underline{\underline{\text{een rode én een witte}}}) = P(\text{een rode uit I én een witte uit II}) = \frac{5}{a} \cdot \frac{a-3}{a} = \frac{5a-15}{a^2}$.

27c $P(\underline{\underline{\text{een rode én een zwarte}}}) = P(\text{een zwarte uit I én een rode uit II}) = \frac{a-5}{a} \cdot \frac{3}{a} = \frac{3a-15}{a^2}$.

```
Plot1 Plot2 Plot3
\Y1■(3X-15)/X²
\Y2=■
```

27d $P(\underline{\underline{\text{een rode én een zwarte}}}) = \frac{3a-15}{a^2}$ is maximaal 0,15 (zie TABLE) voor $a = 10$.
Er zitten dan 5 rode knikkers, dus $10 - 5 = 5$ zwarte in vaas I.

```
X     Y1
6     .08333
7     .12245
8     .14063
9     .14815
10    .15
11    .14876
12    .14583
X=10
```

27e $P(\underline{\underline{\text{een rode én een zwarte}}}) = \frac{3a-15}{a^2} > 0{,}1$ (zie TABLE) voor $a = 7$ tot en met $a = 23$.
Er zitten 7 of 8 of 9 of ... of 22 of 23 knikkers in vaas I.

```
X     Y1
19    .11634
20    .1125
21    .10884
22    .10537
23    .10208
24    .09896
25    .096
X=23
```

28a $P(\text{uit beide vazen een rode}) = P(\text{een rode uit I én een rode uit II}) = \frac{3}{8} \cdot \frac{10-a}{10} = \frac{30-3a}{80}$.

28b $P(\text{uit beide vazen een witte}) = P(\text{een witte uit I én een witte uit II}) = \frac{5}{8} \cdot \frac{a}{10} = \frac{5a}{80} = \frac{a}{16}$.

28c $P(\underline{\underline{\text{een rode én een witte}}}) = P(\text{rode uit I én witte uit II}) + P(\text{witte uit I én rode uit II})$

$$= \frac{3+a}{8+a} \cdot \frac{a}{10} + \frac{5}{8+a} \cdot \frac{10-a}{10} = \frac{a \cdot (3+a)}{10 \cdot (8+a)} + \frac{5 \cdot (10-a)}{10 \cdot (8+a)} = \frac{3a+a^2}{80+10a} + \frac{50-5a}{80+10a} = \frac{a^2-2a+50}{10a+80}.$$

```
Plot1 Plot2 Plot3
\Y1■(X²-2X+50)/(
10X+80)
\Y2■0.5
\Y3=■
```

```
X     Y1       Y2
0     .625     .5
1     .54444   .5
2     .5       .5
3     .48182   .5
4     .48333   .5
5     .5       .5
6     .52857   .5
Y1=.5
```

28d $P(\underline{\underline{\text{een rode én een witte}}}) = \frac{a^2-2a+50}{10a+80} = 0{,}5$ (TABLE) $\Rightarrow a = 2$ of $a = 5$. Dus 2 of 5 rode knikkers toevoegen aan vaas I.

29a $P(\text{uit beide vazen een witte}) = P(\text{een witte uit I én een witte uit II}) = \frac{6}{q} \cdot \frac{12-q}{12} = \frac{12-q}{q} \cdot \frac{6}{12} = \frac{12-q}{q} \cdot \frac{1}{2} = \frac{12-q}{2q}$.

29b $P(\underline{\underline{\text{een witte én een zwarte}}}) = P(\text{witte uit I én zwarte uit II}) + P(\text{zwarte uit I én witte uit II})$

$$= \frac{6}{q} \cdot \frac{q}{12} + \frac{q-6}{q} \cdot \frac{12-q}{12} = \frac{6q}{12q} + \frac{(q-6)\cdot(12-q)}{12q} = \frac{6q}{12q} + \frac{12q-q^2-72+6q}{12q} = \frac{-q^2+24q-72}{12q}.$$

30 De beweringen I en III zijn beide waar.

```
4 nCr 2/7 nCr 2
          .2857142857
4/7*3/6
          .2857142857
■
```

31a $P(\text{rr}) = \frac{p}{50} \cdot \frac{p-1}{49} = \frac{p \cdot (p-1)}{50 \cdot 49} = \frac{p^2-p}{2450}$.

```
50*49
                2450
■
```

31b $P(\underline{\underline{\text{rw}}}) = \binom{2}{1} \cdot P(\text{rw}) = \binom{2}{1} \cdot \frac{p}{50} \cdot \frac{50-p}{49} = \frac{2p \cdot (50-p)}{50 \cdot 49} = \frac{p \cdot (50-p)}{25 \cdot 49} = \frac{50p-p^2}{1225}$.

```
2 nCr 1
                   2
25*49
                1225
■
```

31c $P(\underline{\underline{\text{rw}}}) = \frac{50p-p^2}{1225} > 0{,}5$ (TABLE) $\Rightarrow p = 22 \vee p = 23 \vee p = 24 \vee ... \vee p = 28$.
Er zitten dus $50 - 22 = 28$ of 27 of 26 of 25 of 24 of 23 of 22 witte knikkers in de vaas.

```
Plot1 Plot2 Plot3
\Y1■(50X-X²)/122
5
\Y2■0.5
\Y3=■
```

```
X     Y1       Y2
22    .50286   .5
23    .50694   .5
24    .50939   .5
25    .5102    .5
26    .50939   .5
27    .50694   .5
28    .50286   .5
X=28
```

32a $P(\text{rr}) = \frac{10}{a} \cdot \frac{9}{a-1} = \frac{90}{a \cdot (a-1)} = \frac{90}{a^2-a}$.

32b $P(\underline{\underline{\text{rz}}}) = \binom{2}{1} \cdot P(\text{rz}) = \binom{2}{1} \cdot \frac{10}{a} \cdot \frac{a-10}{a-1} = \frac{2 \cdot 10 \cdot (a-10)}{a \cdot (a-1)} = \frac{20 \cdot (a-10)}{a^2-a} = \frac{20a-200}{a^2-a}$.

```
Plot1 Plot2 Plot3
\Y1■(20X-200)/(X
²-X)
\Y2■0.5
\Y3=■
```

32c $P(\underline{\underline{\text{rz}}}) = \frac{20a-200}{a^2-a} > 0{,}5$ (TABLE) $\Rightarrow a = 17 \vee a = 18 \vee a = 19 \vee ... \vee a = 24$.
Er zitten dus 17 of 18 of 19 of 20 of 21 of 22 of 23 of 24 knikkers in de vaas.

```
X     Y1       Y2
16    .5       .5
17    .51471   .5
18    .52288   .5
19    .52632   .5
20    .52632   .5
21    .52381   .5
22    .51948   .5
X=22
```

33a $P(\text{tweede knikker is pas rood}) = P(\text{zr}) = \frac{8-a}{8} \cdot \frac{a}{7} = \frac{a \cdot (8-a)}{8 \cdot 7} = \frac{8a-a^2}{56}$.

```
Plot1 Plot2 Plot3
\Y1■(8X-X²)/56
\Y2■0.125
\Y3=■
```

33b $P(\text{zr}) = \frac{8a-a^2}{56} = 0{,}125$ (TABLE) $\Rightarrow a = 1 \vee a = 7$. Er zitten dus 1 of 7 rode knikkers in de vaas.

```
X     Y1       Y2
1     .125     .125
2     .21429   .125
3     .26786   .125
4     .28571   .125
5     .26786   .125
6     .21429   .125
7     .125     .125
X=7
```

34a $P(\text{tweede knikker is pas zwart}) = P(\text{rz}) = \frac{8}{a} \cdot \frac{a-8}{a-1} = \frac{8 \cdot (a-8)}{a \cdot (a-1)} = \frac{8a-64}{a^2-a}$.

34b $P(\text{derde knikker is pas zwart}) = P(\text{rrz}) = \frac{8}{a} \cdot \frac{7}{a-1} \cdot \frac{a-8}{a-2} = \frac{56 \cdot (a-8)}{a \cdot (a-1) \cdot (a-2)}$.

```
Plot1 Plot2 Plot3
\Y1■56(X-8)/(X(X
-1)(X-2))
\Y2■0.16
\Y3=■
```

```
X     Y1       Y2
8     0        .16
9     .11111   .16
10    .15556   .16
11    .1697    .16
12    [illegible]   .16
13    .16317   .16
14    .15385   .16
Y1=.16969696969697
```

$P(\text{rrz}) = \frac{56 \cdot (a-8)}{a \cdot (a-1) \cdot (a-2)} > 0{,}16$ (TABLE) $\Rightarrow a = 11 \vee a = 12 \vee a = 13$. Er zitten dus 11 of 12 of 13 knikkers in de vaas.

35 $P(\text{minstens één waardebon}) = 1 - P(\text{geen waardebon}) = 1 - P(\overline{w}\,\overline{w}\,\overline{w}\,\overline{w}) = 1 - \frac{\binom{17}{4}}{\binom{20}{4}} \approx 0{,}509$ *of* $1 - \frac{17}{20} \cdot \frac{16}{19} \cdot \frac{15}{18} \cdot \frac{14}{17} = \frac{29}{57}$.

```
1-17 nCr 4/20 nC
r 4
        .5087719298
■
```

```
1-17/20*16/19*15
/18*14/17
        .5087719298
Ans▸Frac
              29/57
■
```

36 $p = P(\text{succes}) = P(\text{minstens één prijs}) = 1 - P(\text{geen prijs}) = 1 - \frac{\binom{45}{3}}{\binom{50}{3}} \approx 0{,}276$.

```
1-45 nCr 3/50 nC
r 3
        .2760204082
■
```

37a $p = P(\text{succes}) = P(6\,6) = \frac{1}{36} \approx 0{,}028.$

37b $p = P(\text{dubbel}) = \frac{6}{36} = \frac{1}{6} \approx 0{,}167.$

37c $p = P(\text{som} > 10) = \frac{3}{36} = \frac{1}{12} \approx 0{,}083.$

```
1/36
       .0277777778
6/36
       .1666666667
3/36
       .0833333333
```

6						66
5						
4						
3						
2						
1						
	1	2	3	4	5	6

6						66
5					55	
4				44		
3			33			
2		22				
1	11					
	1	2	3	4	5	6

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

38a $P(33\bar{3}\bar{3}\bar{3}\bar{3}) = \frac{1}{4}\cdot\frac{1}{4}\cdot\frac{3}{4}\cdot\frac{3}{4}\cdot\frac{3}{4}\cdot\frac{3}{4} = (\frac{1}{4})^2\cdot(\frac{3}{4})^4 \approx 0{,}020.$

38b $P(3\bar{3}3\bar{3}\bar{3}\bar{3}) = \frac{1}{4}\cdot\frac{3}{4}\cdot\frac{1}{4}\cdot\frac{3}{4}\cdot\frac{3}{4}\cdot\frac{3}{4} \approx 0{,}020.$

```
(1/4)²*(3/4)^4
       .0197753906
```

38c $\underline{33\bar{3}\bar{3}\bar{3}\bar{3}}$ heeft $\binom{6}{2} = 15$ rijtjes.

```
6 nCr 2
                15
```

38d $P(\underline{33\bar{3}\bar{3}\bar{3}\bar{3}}) = \binom{6}{2}\cdot(\frac{1}{4})^2\cdot(\frac{3}{4})^4 \approx 0{,}297.$

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

39a $n = 6,\ p = P(\text{succes}) = P(\text{r}) = \frac{8}{20} = \frac{4}{10} = 0{,}4$ en $P(X = 4) = P(\underline{\text{rrrr}\bar{\text{r}}\bar{\text{r}}}) = \binom{6}{4}\cdot 0{,}4^4\cdot 0{,}6^2 \approx 0{,}138.$

```
6 nCr 4*0.4^4*0.
6²
            .13824
```

39b $n = 12,\ p = P(\text{succes}) = P(\bar{\text{w}}) = \frac{18}{20} = \frac{9}{10} = 0{,}9$ en $P(Y = 10) = P(\underline{\bar{\text{w}}\bar{\text{w}}\bar{\text{w}}\bar{\text{w}}\bar{\text{w}}\bar{\text{w}}\bar{\text{w}}\bar{\text{w}}\bar{\text{w}}\bar{\text{w}}\text{ww}}) = \binom{12}{10}\cdot 0{,}9^{10}\cdot 0{,}1^2 \approx 0{,}230.$

```
12 nCr 10*0.9^10
*0.1²
       .2301277705
```

40a X, het aantal keer slag (s), is binomiaal verdeeld met $n = 10$ en $p = 0{,}3$.
$P(X = 5) = P(\underline{\text{sssss}\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}}) = \binom{10}{5}\cdot 0{,}3^5\cdot 0{,}7^5 \approx 0{,}103.$

40b $P(\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}\text{s}) = 0{,}7^4\cdot 0{,}3 \approx 0{,}072.$

```
10 nCr 5*0.3^5*0
.7^5
       .1029193452
0.7^4*0.3
            .07203
```

41a X, het aantal personen waarbij NATURA G3 succes (s) heeft, is binomiaal verdeeld met $n = 12$ en $p = 0{,}8$.
$P(X = 8) = P(\underline{\text{ssssssss}\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}}) = \binom{12}{8}\cdot 0{,}8^8\cdot 0{,}2^4 \approx 0{,}133.$

41b $P(X = 6) = P(\underline{\text{ssssss}\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}\bar{\text{s}}}) = \binom{12}{6}\cdot 0{,}8^6\cdot 0{,}2^6 \approx 0{,}016.$

```
12 nCr 8*0.8^8*0
.2^4
       .1328755507
12 nCr 6*0.8^6*0
.2^6
       .0155021476
```

42a $P(X \le 2) = P(X = 0) + P(X = 1) + P(X = 2) = 0{,}512 + 0{,}384 + 0{,}096 = 0{,}992.$

```
1-0.008
              .992
```

42b $P(X \le 3) = P(X = 0) + P(X = 1) + P(X = 2) + P(X = 3) = 1.$ (er zijn geen andere waarden voor X mogelijk)

42c $P(X \le 0) = P(X = 0).$ (er zijn geen waarden voor X met $X < 0$)

42d Zie de tabel hiernaast.

x	0	1	2	3
$P(X \le x)$	0,512	0,896	0,992	1

```
0.512+0.384
              .896
Ans+0.096
              .992
Ans+0.008
                 1
```

✻✻✻ **Neem GR - practicum 12 door.** (zie aan het eind van deze uitwerkingen)

43a $P(B = 5) = \text{binompdf}(10, \frac{1}{5}, 5) \approx 0{,}026.$ (B = het aantal keer banaan)

```
binompdf(10,1/5,
5)
       .0264241152
```

43b $P(A = 3) = \text{binompdf}(18, \frac{2}{5}, 3) \approx 0{,}025.$ (A = het aantal keer appel)

```
binompdf(18,2/5,
3)
       .0245549406
```

43c $P(A \le 2) = \text{binomcdf}(20, \frac{2}{5}, 2) \approx 0{,}004.$

```
binomcdf(20,2/5,
2)
       .0036114721
```

43d $P(B = 4) = \text{binompdf}(5, \frac{1}{5}, 4) \approx 0{,}006.$

```
binompdf(5,1/5,4
)
             .0064
```

44a $P(B = 4) = \text{binompdf}(6, 0.75, 4) \approx 0{,}297.$ (B = het aantal kinderen met bruine ogen van ouders met bruine ogen)

```
binompdf(6,0.75,
4)
       .2966308594
```

44b $P(B \le 4) = \text{binomcdf}(6, 0.75, 4) \approx 0{,}466.$

```
binomcdf(6,0.75,
4)
       .4660644531
```

45a $P(X = 10) = \text{binompdf}(60, 0.16, 10) \approx 0{,}136.$ (X = het aantal auto's dat harder dan 120 km/u rijdt)

45b $P(Y \le 2) = \text{binomcdf}(60, \frac{1}{4}\times 0.16, 2) \approx 0{,}568.$ (Y = het aantal auto's dat harder dan 140 km/u rijdt)

```
binompdf(60,0.16
,10)
       .1356753885
binomcdf(60,1/4*
0.16,2)
       .5675865672
```

45c $P(Z = \frac{1}{4}\times 60) = \text{binompdf}(60, \frac{3}{4}\times 0.16, \frac{1}{4}\times 60) \approx 0{,}003.$ (Z = het aantal auto's dat tussen 120 km/u en 140 km/u rijdt)

```
binompdf(60,3/4*
0.16,1/4*60)
       .0026019702
```

46a Marianne moet van de 8 vragen, die ze gokt, er nog 4 goed gokken. ($12\times\frac{1}{2} + 4\times\frac{1}{2} = 6 + 2 = 8$)
$P(X = 4) = \text{binompdf}(8, \frac{1}{5}, 4) \approx 0{,}046.$

46b Linda mag van de 10 vragen, die ze gokt, er hoogstens 2 goed gokken. ($10\times\frac{1}{2} + 2\times\frac{1}{2} = 5 + 1 = 6$)
$P(X \le 2) = \text{binomcdf}(10, \frac{1}{5}, 2) \approx 0{,}678.$

```
binompdf(8,1/5,4
)
          .0458752
binomcdf(10,1/5,
2)
         .677799526
```

47a $P(\text{in } B \text{ uitkomen}) = P(X = 2) = \text{binompdf}(8, \frac{1}{6}, 2) \approx 0{,}260.$ (X = het aantal keer in richting oost)

```
binompdf(8,1/6,2
)
       .2604762041
```

47b $P(\text{in } C \text{ uitkomen}) = P(X = 4) = \text{binompdf}(8, \frac{1}{6}, 4) \approx 0{,}026.$

```
binompdf(8,1/6,4
)
       .0260476204
```

47c $P(\text{via } A \text{ naar } B) = P(\text{in } A \text{ uitkomen})\cdot P(\text{in } B \text{ uitkomen}) = \text{binompdf}(5, \frac{1}{6}, 1)\cdot\text{binompdf}(3, \frac{1}{6}, 1) \approx 0{,}140.$

```
binompdf(5,1/6,1
)*binompdf(3,1/6
,1)
       .1395408236
```

47d $P(\text{boven de lijn } AC \text{ uitkomen}) = P(X \le 3) = \text{binomcdf}(8, \frac{1}{6}, 3) \approx 0{,}969.$ (5 keer of vaker naar het noorden)

```
binomcdf(8,1/6,3
)
       .9693435881
```

48a 1. $P(X \le 5)$.
2. $P(X = 4)$.
3. $P(X \ge 7)$.

48b 1. $P(X \ge 10) = 1 - P(X \le 9)$.
2. $P(X > 5) = 1 - P(X \le 5)$.
3. $P(X < 7) = P(X \le 6)$.
4. $P(X \ge 6) = 1 - P(X \le 5)$.

x	0	1	2	3	4	5	6	7	8	9	10	11	12	...
48a1	■	■	■	■	■	■								
48a2					■									
48a3	-	-	-	-	-	-	-	■	■	■	■	■	■	■
48b1	-	-	-	-	-	-	-	-	-	-	■	■	■	■
48b2	-	-	-	-	-	-	■	■	■	■	■	■	■	■
48b3	■	■	■	■	■	■	■							
48b4	-	-	-	-	-	-	■	■	■	■	■	■	■	■

49a $P(4 < X < 9) = P(X \le 8) - P(X \le 4)$.
49b $P(1 < X < 7) = P(X \le 6) - P(X \le 1)$.
49c $P(5 \le X \le 10) = P(X \le 10) - P(X \le 4)$.
$P(4 < X < 9) = P(X \le 8) - P(X \le 4)$. (zie 49a)

x	0	1	2	3	4	5	6	7	8	9	10	...
49a	-	-	-	-	-	■	■	■	■			
49b	-	-	■	■	■	■	■					
49c1	-	-	-	-	-	■	■	■	■	■	■	

50a $P(X > 2) = 1 - P(X \le 2)$.
50b $P(X \ge 10) = 1 - P(X \le 9)$.
50c $P(3 < X < 8) = P(X \le 7) - P(X \le 3)$.
50d $P(2 < X < 11) = P(X \le 10) - P(X \le 2)$.
50e $P(X \ge 8) = 1 - P(X \le 7)$.
50f $P(2 \le X \le 9) = P(X \le 9) - P(X \le 1)$.

x	0	1	2	3	4	5	6	7	8	9	10	11	12	...
50a	-	-	-	■	■	■	■	■	■	■	■	■	■	■
50b	-	-	-	-	-	-	-	-	-	-	■	■	■	■
50c	-	-	-	-	■	■	■	■						
50d	-	-	-	■	■	■	■	■	■	■	■			
50e	-	-	-	-	-	-	-	-	■	■	■	■	■	■
50f	-	-	■	■	■	■	■	■	■	■				

51a $P(X < 10) = P(X \le 9) = \text{binomcdf}(25{,}0.42{,}9) \approx 0{,}347$.
51b $P(X \ge 8) = 1 - P(X \le 7) = 1 - \text{binomcdf}(25{,}0.42{,}7) \approx 0{,}889$.
51c $P(9 < X < 16) = P(X \le 15) - P(X \le 9) = \text{binomcdf}(25{,}0.42{,}15) - \text{binomcdf}(25{,}0.42{,}9) \approx 0{,}631$.
51d $P(X \ge 6) = 1 - P(X \le 5) = 1 - \text{binomcdf}(25{,}0.42{,}5) \approx 0{,}982$.
51e $P(7 < X < 12) = P(X \le 11) - P(X \le 7) = \text{binomcdf}(25{,}0.42{,}11) - \text{binomcdf}(25{,}0.42{,}7) \approx 0{,}550$.
51f $P(8 \le X \le 10) = P(X \le 10) - P(X \le 7) = \text{binomcdf}(25{,}0.42{,}10) - \text{binomcdf}(25{,}0.42{,}7) \approx 0{,}394$.

```
binomcdf(25,0.42,9)
            .3465197315
1-binomcdf(25,0.42,7)
            .8893514177
binomcdf(25,0.42,15)-binomcdf(25,0.42,9)
            .6314541052
1-binomcdf(25,0.42,5)
            .9815972238
binomcdf(25,0.42,11)-binomcdf(25,0.42,7)
            .5496288601
binomcdf(25,0.42,10)-binomcdf(25,0.42,7)
            .3937397825
```

52a $P(X \ge 4) = 1 - P(X \le 3) = 1 - \text{binomcdf}(50{,}0.13{,}3) \approx 0{,}904$.
52b $P(X > 4) = 1 - P(X \le 4) = 1 - \text{binomcdf}(50{,}0.13{,}4) \approx 0{,}796$.
52c $P(X = 5 \text{ of } X = 6) = P(X \le 6) - P(X \le 4) = \text{binomcdf}(50{,}0.13{,}6) - \text{binomcdf}(50{,}0.13{,}4) \approx 0{,}317$.
52d $P(7 < X < 14) = P(X \le 13) - P(X \le 7) = \text{binomcdf}(50{,}0.13{,}13) - \text{binomcdf}(50{,}0.13{,}7) \approx 0{,}318$.

```
1-binomcdf(50,0.13,3)
            .9042343479
1-binomcdf(50,0.13,4)
            .7956035504
binomcdf(50,0.13,6)-binomcdf(50,0.13,4)
            .3166955804
binomcdf(50,0.13,13)-binomcdf(50,0.13,7)
            .3179762382
```

53a $P(A \ge 5) = 1 - P(A \le 4) = 1 - \text{binomcdf}(10, \frac{3}{6}, 4) \approx 0{,}623$.
53b $P(10 < A < 20) = P(A \le 19) - P(A \le 10) = \text{binomcdf}(25, \frac{3}{6}, 19) - \text{binomcdf}(25, \frac{3}{6}, 10) \approx 0{,}786$.
53c $P(B > 40) = 1 - P(B \le 40) = 1 - \text{binomcdf}(100, \frac{2}{6}, 40) \approx 0{,}066$.
53d $P(K = 7) = \text{binompdf}(35, \frac{1}{6}, 7) \approx 0{,}146$.
53e $P(K = 0) = \text{binompdf}(10, \frac{1}{6}, 0)$ of $\left(\frac{5}{6}\right)^{10} \approx 0{,}162$.

```
1-binomcdf(10,3/6,4)
            .623046875
binomcdf(25,3/6,19)-binomcdf(25,3/6,10)
            .7857832306
1-binomcdf(100,2/6,40)
            .065872156
binompdf(35,1/6,7)
            .145722847
binompdf(10,1/6,0)
            .1615055829
(5/6)^10
            .1615055829
```

54a $P(E > 10) = 1 - P(E \le 10) = 1 - \text{binomcdf}(16, \frac{3}{6}, 10) \approx 0{,}105$.
54b $P(D < 2) = P(D \le 1) = \text{binomcdf}(16, \frac{1}{6}, 1) \approx 0{,}227$.
54c $P(Z = 5) = \text{binompdf}(16, \frac{1}{6}, 5) \approx 0{,}076$.

```
1-binomcdf(16,3/6,10)
            .1050567627
binomcdf(16,1/6,1)
            .2271691503
binompdf(16,1/6,5)
            .0756018932
```

55 De kans dat Rob de baan krijgt is $P(G \ge 7) = 1 - \text{binomcdf}(9, \frac{9}{10}, 6) \approx 0{,}947$.

```
1-binomcdf(9,9/10,6)
            .947027862
```

56a $p = P(\text{succes}) = P(rr) = \dfrac{\binom{12}{2}}{\binom{25}{2}} = 0{,}22$. De gevraagde kans is $P(X = 3) = \text{binompdf}(15{,}0.22{,}3) \approx 0{,}246$.

```
12 nCr 2/25 nCr 2
            .22
binompdf(15,Ans,3)
            .2457053831
```

56b $p = P(\text{succes}) = P(\underline{z\bar{z}}) = \dfrac{\binom{8}{1}\cdot\binom{17}{1}}{\binom{25}{2}} \approx 0{,}453\ldots$ *Gevraagd:* $P(Y \ge 10) = 1 - P(Y \le 9) = 1 - \text{binomcdf}(15, Ans, 9) \approx 0{,}081$.

```
8 nCr 1*17 nCr 1/25 nCr 2
            .4533333333
Ans►Frac
            34/75
```

```
8 nCr 1*17 nCr 1/25 nCr 2
            .4533333333
1-binomcdf(15,Ans,9)
            .0808104939
```

56c $p = P(\text{twee van dezelfde kleur}) = P(rr) + P(zz) + P(ww) = 0{,}22 + \dfrac{\binom{8}{2}}{\binom{25}{2}} + \dfrac{\binom{5}{2}}{\binom{25}{2}} = \dfrac{26}{75}$.

Gevraagde: $P(Z < 6) = P(Z \le 5) = \text{binomcdf}(15, \frac{26}{75}, 5) \approx 0{,}575$.

56d $p = P(\text{minstens één rode}) = 1 - P(\bar{r}\bar{r}) = 1 - \dfrac{\binom{13}{2}}{\binom{25}{2}} = 0{,}74$. Dus $P(R \ge 8) = 1 - P(R \le 7) = 1 - \text{binomcdf}(15, 0.74, 7) \approx 0{,}978$.

57a $P(S > 0{,}6 \times 120) = P(S > 72) = 1 - P(E \le 72) = 1 - \text{binomcdf}(120, 1 - \frac{1}{3}, 72) \approx 0{,}925$.

57b $P(V \ge \frac{1}{2} \times 6) = P(V \ge 3) = 1 - P(V \le 2) = 1 - \text{binomcdf}(6, 0.40, 2) \approx 0{,}456$.

58a $P(N \ge 20) = 1 - P(N \le 19) = 1 - \text{binomcdf}(80, 0.22, 19) \approx 0{,}298$.

58b $P(16 < B < 24) = P(B \le 23) - P(B \le 16) = \text{binomcdf}(80, 0.36, 23) - \text{binomcdf}(80, 0.36, 16) \approx 0{,}106$.

58c $P(16 < N < 24) = \text{binomcdf}(80, 0.28, 23) - \text{binomcdf}(80, 0.28, 16) \approx 0{,}547$.

58d $P(\underline{\underline{NNBBBBnnnn}}) = \binom{10}{2} \cdot \binom{8}{4} \cdot P(NNBBBBnnnn) = \binom{10}{2} \cdot \binom{8}{4} \cdot 0{,}22^2 \cdot 0{,}36^4 \cdot 0{,}28^4 \approx 0{,}016$.

59a $P(10 < M < 15) = P(M \le 14) - P(M \le 10) = \text{binomcdf}(25, \frac{1}{2}, 14) - \text{binomcdf}(25, \frac{1}{2}, 10) \approx 0{,}576$.

59b $p = P(mm) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$ en $P(X \le 5) = \text{binomcdf}(30, \frac{1}{4}, 5) \approx 0{,}203$.

59c $p = P(5 \text{ of } 6) = \frac{2}{6}$ en $P(Y \le 10) = \text{binomcdf}(15, \frac{2}{6}, 10) \approx 0{,}998$.

59d $p = P(som > 7) = \frac{15}{36}$ (zie het rooster op het voorblad) en $P(Z = 5) = \text{binompdf}(18, \frac{15}{36}, 5) \approx 0{,}097$.

60 $P(X \le 92) = \text{binomcdf}(100, 1 - 0.12, 92) \approx 0{,}924$.

61a $P(N \ge 1) = 1 - P(N \le 0) = 1 - \text{binomcdf}(10, 0.025, 0)$ of $1 - \text{binompdf}(10, 0.025, 0)$ of $1 - 0{,}975^{10} \approx 0{,}224$.

61b $P(G \ge 38) = 1 - P(G \le 37) = 1 - \text{binomcdf}(40, 0.975, 37) \approx 0{,}922$.

61c $P(N \ge 1) = 1 - P(N \le 0) = 1 - \text{binomcdf}(10, 0.01, 0) \approx 0{,}096$.

62a $P(M \ge 5) = 1 - P(M \le 4) = 1 - \text{binomcdf}(n, \frac{1}{2}, 4) > 0{,}99$ (TABLE) $\Rightarrow n \ge 19$.

62b $p = P(\text{minstens één munt}) = 1 - P(\bar{m}\bar{m}) = 1 - \frac{1}{2} \cdot \frac{1}{2} = 1 - \frac{1}{4} = \frac{3}{4}$.
$P(X \ge 2) = 1 - P(X \le 1) = 1 - \text{binomcdf}(n, \frac{3}{4}, 1) \ge 0{,}98$ (TABLE) $\Rightarrow n \ge 5$.

63 $P(S \ge 5) = 1 - P(S \le 4) = 1 - \text{binomcdf}(n, 0.40, 4) > 0{,}90$ (TABLE) $\Rightarrow n \ge 18$.

64 $p = P(\text{succes}) = P(ww) = \dfrac{\binom{6}{2}}{\binom{10}{2}} = \dfrac{1}{3}$.
$P(X \ge 3) = 1 - P(X \le 2) = 1 - \text{binomcdf}(n, \frac{1}{3}, 2) > 0{,}95$ (TABLE) $\Rightarrow n \ge 17$.

65a Opp. $= \text{normalcdf}(13, 19, 15, 2.8) \approx 0{,}686$.

65b Opp. $= \text{normalcdf}(-10\text{^}99, 20.4, 15, 2.8) \approx 0{,}973$.

65c Opp. $= \text{normalcdf}(21.3, 10\text{^}99, 15, 2.8) \approx 0{,}012$.

66a $p = P(\text{groot}) = \text{normalcdf}(80, 10\text{^}99, 75, 18) \approx 0{,}391$.

66b $P(G = 5) = \text{binompdf}(5, p, 5)$ of $p^5 \approx 0{,}009$.

67a $p = P(G < 125) = \text{normalcdf}(-10\text{^}99, 125, 130, 5) \approx 0{,}158...$
$P(X \le 4) = \text{binomcdf}(50, p, 4) \approx 0{,}085$.

67b $p = P(G < 128) = \text{normalcdf}(-10\text{^}99, 128, 130, 5) \approx 0{,}344...$
$P(Y \ge 8) = 1 - P(Y \le 7) = 1 - \text{binomcdf}(50, p, 7) \approx 0{,}999$.

67c $p = P(G > 132) = \text{normalcdf}(132, 10\text{^}99, 130, 5) \approx 0{,}344...$
$P(Z = 8) = \text{binompdf}(50, p, 8) \approx 0{,}002$.

68a $p = P(D < 14{,}15) = \text{normalcdf}(-10\text{^}99{,}14.15{,}14.31{,}0.12) \approx 0{,}091...$
$P(X \le 5) = \text{binomcdf}(100, p, 5) \approx 0{,}097.$

```
normalcdf(-10^99
,14.15,14.31,0.1
2)
      .0912112819
binomcdf(100,Ans
,5)
      .0974990032
```

68b $p = P(G > 14{,}50) = \text{normalcdf}(14.50{,}10\text{^}99{,}14.31{,}0.12) \approx 0{,}056...$
$P(Y \ge 10) = 1 - P(Y \le 9) = 1 - \text{binomcdf}(100, p, 9) \approx 0{,}057.$

```
normalcdf(14.50,
10^99,14.31,0.12
)
      .0566727574
1-binomcdf(100,A
ns,9)
       .057373702
```

69a $p = P(T > 2 \times 60) = P(T > 120) = \text{normalcdf}(120{,}10\text{^}99{,}112{,}5) \approx 0{,}054...$
$P(X \ge 4) = 1 - P(X \le 3) = 1 - \text{binomcdf}(22, p, 3) \approx 0{,}030.$

```
normalcdf(120,10
^99,112,5)
      .0547992894
1-binomcdf(22,An
s,3)
      .0298532024
```

69b $p = P(T < 60 + 3 \times 15) = P(T < 105) = \text{normalcdf}(-10\text{^}99{,}105{,}112{,}5) \approx 0{,}080...$
Je verwacht dat er $120 \times p \approx 10$ optredens korter duren dan één uur en drie kwartier.

```
normalcdf(-10^99
,105,112,5)
      .0807567112
Ans*120
       9.69080534
```

70 $\text{Winst} = \text{Opbrengst} - \text{Kosten} = 1000 \times 5 - 2000 - 100 \times 20 = 5000 - 2000 - 2000 = 1000$ (€).
Gemiddeld maakt Excelsior $\frac{1000}{1000} = 1$ euro winst per lot.

71a $P(U = 50) = \frac{1}{100}$ en $P(U = 10) = \frac{3}{100}$. Niet nodig: $P(U = 0) = 1 - \frac{1}{100} - \frac{3}{100} = \frac{96}{100}$.
$E(U) = 50 \times 0{,}01 + 10 \times 0{,}03 + 0 \times ... = 0{,}80$ (€).
$E(W) = E(U) - \text{inzet}$ (per lot) $= 0{,}80 - 2 = -1{,}20$ (€).

u	50	10	0
$P(U = u)$	0,01	0,03	...

```
50*0.01+10*0.03
               .8
Ans-2
             -1.2
```

71b Eerlijk spel $\Rightarrow E(W) = 0 \Rightarrow E(U) - \text{inzet} = 0 \Rightarrow E(U) = \text{inzet} \Rightarrow \text{inzet} = 0{,}80$ (€).

72 $P(U = 25) = P(\text{r}) = \frac{1}{20} = 0{,}05$ en $P(U = 10) = P(\text{b}) = \frac{2}{20} = 0{,}10.$
$E(U) = 25 \times 0{,}05 + 10 \times 0{,}10 + 0 \times ... = 2{,}25$ (€).

u	25	10	0
$P(U = u)$	0,05	0,1	...

```
1/20
              .05
2/20
               .1
25*1/20+10*2/20
             2.25
```

73a $P(U = 100) = \frac{1}{1000}$; $P(U = 50) = \frac{5}{1000}$; $P(U = 25) = \frac{10}{1000}$ en $P(U = 10) = \frac{25}{1000}$.
$E(U) = 100 \times \frac{1}{1000} + 50 \times \frac{5}{1000} + 25 \times \frac{10}{1000} + 10 \times \frac{25}{1000} + 0 \times ... = 0{,}85$ (\$).
$E(W) = E(U) - \text{inzet} = 0{,}85 - 1 = -0{,}15$ (\$).

u	100	50	25	10	0
$P(U = u)$	0,001	0,005	0,010	0,025	...

```
100*0.001+50*0.0
05+25*0.010+10*0
.025
              .85
Ans-1
             -.15
```

73b Deze winkelier kon op een dag $500 \times 0{,}15 = 75$ (\$) winst verwachten.

```
500*0.15
               75
```

74a $P(U = 10\,000) = \frac{1}{10 \cdot 9 \cdot 8 \cdot 7} = \frac{1}{5040}.$

74b $E(U) = 10\,000 \times \frac{1}{5040} + 0 \times ... \approx 1{,}98$ (\$).
$E(W) = E(U) - \text{inzet} = 1{,}98 - 2{,}50 = -0{,}52$ (\$).

u	10000	0
$P(U = u)$	$\frac{1}{5040}$	...

```
10*9*8*7
             5040
10000/5040
      1.984126984
Ans-2.5
     -.5158730159
```

74c De staat Maine kan die week $20\,000 \times -E(W) - 7\,500 \approx 2\,817{,}46$ (\$) winst verwachten.

```
-Ans
      .5158730159
Ans*20000
      10317.46032
Ans-7500
      2817.460317
```

75a $P(5\underline{\underline{5}}\,\underline{\underline{5}}) = P(U = 1) = \text{binompdf}(3, \frac{1}{6}, 1) = \frac{25}{72}$ of $\binom{3}{1} \cdot \frac{1}{6} \cdot (\frac{5}{6})^2 = \frac{75}{216} = \frac{25}{72}.$

```
binompdf(3,1/6,1
)
      .3472222222
Ans▸Frac
            25/72
```

```
3 nCr 1*1/6*(5/6
)²▸Frac
            25/72
3 nCr 2*(1/6)²*5
/6▸Frac
             5/72
```

75b $P(55\underline{\underline{5}}) = P(U = 2) = \text{binompdf}(3, \frac{1}{6}, 2) = \frac{5}{72}$ of $\binom{3}{2} \cdot (\frac{1}{6})^2 \cdot \frac{5}{6} = \frac{15}{216} = \frac{5}{72}.$

```
binompdf(3,1/6,2
)▸Frac
             5/72
```

75c $P(\underline{\underline{5}}\,\underline{\underline{5}}\,\underline{\underline{5}}) = P(U = 0) = \text{binompdf}(3, \frac{1}{6}, 0)$ of $(\frac{5}{6})^3 = \frac{125}{216}.$

```
binompdf(3,1/6,0
)▸Frac
          125/216
binompdf(3,1/6,3
)▸Frac
            1/216
```

```
(5/6)^3▸Frac
          125/216
(1/6)^3▸Frac
            1/216
```

75d $P(555) = P(U = 3) = \text{binompdf}(3, \frac{1}{6}, 3) = \frac{1}{216}$ of $(\frac{1}{6})^3 = \frac{1}{216}.$
$E(U) = 1 \times \frac{25}{72} + 2 \times \frac{5}{72} + 3 \times \frac{1}{216} + 0 \times ... = 0{,}50$ (\$).
Het levert $500 \cdot (1 - E(U)) = 500 \cdot (1 - 0{,}50) = 500 \cdot 0{,}50 = 250$ (\$) op.

```
1*25/72+2*5/72+3
*1/216
               .5
```

u	1	2	3	0
$P(U = u)$	$\frac{25}{72}$	$\frac{5}{72}$	$\frac{1}{216}$	...

76a $P(U = 20) = P(\text{som} = 5 \text{ of } \text{som} = 6) = P(\underline{113}) + P(\underline{122}) + P(\underline{114}) + P(\underline{123}) + P(222)$
$= \binom{3}{2} \cdot (\frac{1}{6})^3 + \binom{3}{1} \cdot (\frac{1}{6})^3 + \binom{3}{2} \cdot (\frac{1}{6})^3 + 3! \cdot (\frac{1}{6})^3 + (\frac{1}{6})^3 = \frac{3}{216} + \frac{3}{216} + \frac{3}{216} + \frac{6}{216} + \frac{1}{216} = \frac{16}{216}.$

```
3 nCr 2
                3
3 nCr 1
                3
3!
                6
```

```
6^3
              216
```

76b $P(\text{geen enkele keer 20 euro}) = (1 - \frac{16}{216})^5 = (\frac{200}{216})^5 \approx 0{,}681.$

```
(200/216)^5
      .680583197
Ans*16/216
      .0504135702
```

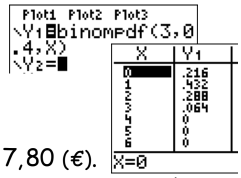
76c $P(\text{bij de zesde keer voor het eerst 20 euro}) = (\frac{200}{216})^5 \cdot \frac{16}{216} \approx 0{,}050.$

u	20	100	30	0
$P(U = u)$	$\frac{16}{216}$	$\frac{3}{216}$	$\frac{10}{216}$	...

76d $P(U = 100) = P(\text{som} = 4) = P(\underline{112}) = \binom{3}{2} \cdot (\frac{1}{6})^3 = \frac{3}{216}.$
$P(U = 30) = P(\text{som} = 16 \text{ of } \text{som} = 17 \text{ of } \text{som} = 18) = P(\underline{664}) + P(\underline{655}) + P(\underline{665}) + P(666)$
$= \binom{3}{2} \cdot (\frac{1}{6})^3 + \binom{3}{1} \cdot (\frac{1}{6})^3 + \binom{3}{2} \cdot (\frac{1}{6})^3 + (\frac{1}{6})^3 = \frac{3}{216} + \frac{3}{216} + \frac{3}{216} + \frac{1}{216} = \frac{10}{216}.$
$E(U) = 20 \times \frac{16}{216} + 100 \times \frac{3}{216} + 30 \times \frac{10}{216} + 0 \times ... = \frac{920}{216}$ (€).
Het spel levert de organisator $800 \cdot (5 - E(U)) = 800 \cdot (5 - \frac{920}{216}) \approx 592{,}59$ (€) op.

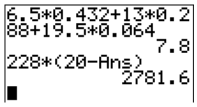
```
20*16+100*3+30*1
0
              920
800*(5-920/216)
      592.5925926
```

77a $P(U=13) = P(s\underline{s}\underline{s}) = \text{binompdf}(3{,}0.4{,}2) = 0{,}288.$



77b $P(U=0) = P(\underline{s}\underline{s}\underline{s}) = \text{binompdf}(3{,}0.4{,}0) = 0{,}216.$
$P(U=6{,}5) = P(s\underline{s}\underline{s}) = \text{binompdf}(3{,}0.4{,}1) = 0{,}432.$
$P(U=19{,}5) = P(sss) = \text{binompdf}(3{,}0.4{,}3) = 0{,}064.$
$E(U) = 0 \times 0{,}216 + 6{,}5 \times 0{,}432 + 13 \times 0{,}288 + 19{,}5 \times 0{,}064 = 7{,}80$ (€).
In juni verwacht hij $228 \times (20 - 7{,}80) = 2\,781{,}60$ (€) op de kaarten te verdienen.

u	0	6,5	13	19,5
$P(U=u)$	0,216	0,432	0,288	0,064

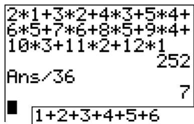


78a $P(Z=4) = \frac{3}{36}$. (zie figuur 11.13)

78b Zie de kansverdeling van Z hiernaast.

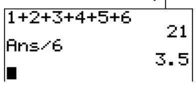
z	2	3	4	5	6	7	8	9	10	11	12
$P(Z=z)$	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

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

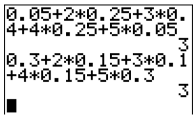


78c Zie de kansverdeling van X (Y dezelfde) hiernaast.
$E(X) = E(Y) = 1 \cdot \frac{1}{6} + 2 \cdot \frac{1}{6} + 3 \cdot \frac{1}{6} + 4 \cdot \frac{1}{6} + 5 \cdot \frac{1}{6} + 6 \cdot \frac{1}{6} = 3{,}5.$
$E(X+Y) = E(Z) = 7$ en $E(X) + E(Y) = 3{,}5 + 3{,}5 = 7.$
Inderdaad is $E(X+Y) = E(X) + E(Y)$.

x	1	2	3	4	5	6
$P(X=x)$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

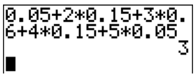


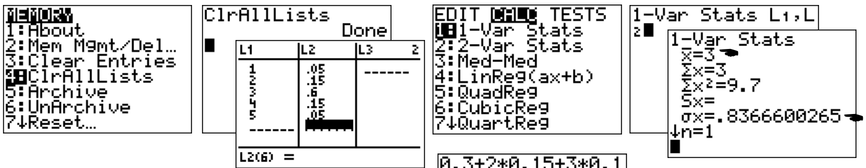
79a $E(X) = 1 \cdot 0{,}05 + 2 \cdot 0{,}25 + 3 \cdot 0{,}4 + 4 \cdot 0{,}25 + 5 \cdot 0{,}05 = 3.$ $(0{,}05 + 0{,}25 + 0{,}4 + 0{,}25 + 0{,}05 = 1)$
$E(Y) = 1 \cdot 0{,}3 + 2 \cdot 0{,}15 + 3 \cdot 0{,}1 + 4 \cdot 0{,}15 + 5 \cdot 0{,}3 = 3.$ $(0{,}3 + 0{,}15 + 0{,}1 + 0{,}15 + 0{,}3 = 1)$

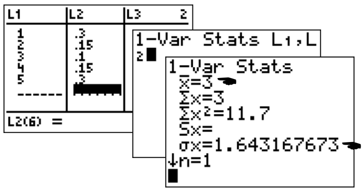


79b De spreiding is het grootst in het histogram bij Y.

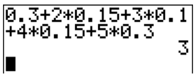
80a $E(X) = 1 \cdot 0{,}05 + 2 \cdot 0{,}15 + 3 \cdot 0{,}6 + 4 \cdot 0{,}15 + 5 \cdot 0{,}05 = 3$ en $\sigma_X \approx 0{,}84$ (1-Var Stats L1,L2).





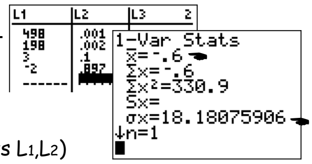


80b $E(Y) = 3$ en $\sigma_Y \approx 1{,}64$ (1-Var Stats L1,L2).



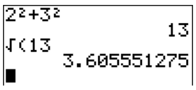
81 Zie de kansverdeling van X hiernaast.
$P(X=498) = \frac{1}{1000}$; $P(X=198) = \frac{2}{1000}$; $P(X=3) = \frac{100}{1000}$
en $P(X=-2) = 1 - \left(\frac{1}{1000} + \frac{2}{1000} + \frac{100}{1000}\right) = 1 - \frac{103}{1000} = \frac{897}{1000}.$
$E(X) = 498 \times \frac{1}{1000} + 198 \times \frac{2}{1000} + 3 \times \frac{100}{1000} - 2 \times \frac{897}{1000} = -0{,}60$ (€) en $\sigma_X \approx 18{,}18$ (€). (1-Var Stats L1,L2)

x	498	198	3	-2
$P(X=x)$	$\frac{1}{1000}$	$\frac{2}{1000}$	$\frac{100}{1000}$	$\frac{897}{1000}$

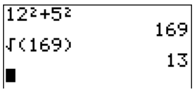


82a $E(T) = E(X+Y) = E(X) + E(Y) = 16 + 30 = 46$ (sec).

82b $\sigma_T = \sigma_{X+Y} = \sqrt{(\sigma_X)^2 + (\sigma_Y)^2} = \sqrt{2^2 + 3^2} = \sqrt{13} \approx 3{,}6$ (sec).



83 $E(B) = E(N) + E(T) = 230 + 30 = 260$ (gram).
$\sigma_B = \sqrt{(\sigma_N)^2 + (\sigma_T)^2} = \sqrt{12^2 + 5^2} = \sqrt{169} = 13$ (gram).

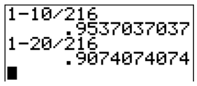


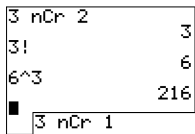
84a De som $X + Y = 7 \Rightarrow$ de standaardafwijking $\sigma_{X+Y} = 0$.

84b X en Y zijn niet onafhankelijk, dus afhankelijk (want er geldt: $X + Y = 7 \Rightarrow Y = 7 - X$).

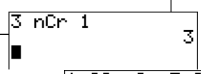
Diagnostische toets

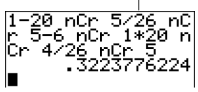
D1a Som 6 kan met $\underline{114}$ (op $\binom{3}{2} = 3$ manieren), $\underline{123}$ (op $3! = 6$ manieren) en 222 (op 1 manier).
$P(\text{som} \neq 6) = 1 - P(\text{som} = 6) = 1 - \frac{3+6+1}{6 \times 6 \times 6} = 1 - \frac{10}{216} \approx 0{,}954.$





D1b $P(\text{som} \geq 7) = 1 - P(\text{som} < 7) = 1 - \frac{1+3+3+3+3+6+1}{6 \times 6 \times 6} = 1 - \frac{20}{216} \approx 0{,}907.$
Som 3 met 111, som 4 met $\underline{112}$, som 5 met $\underline{122}$ en $\underline{113}$ en som 6 met $\underline{114}$, $\underline{123}$ en 222.





D2 $P(\text{minstens twee uit R}) = 1 - P(\text{geen of een uit R}) = 1 - \left(P(\overline{R}\overline{R}\overline{R}\overline{R}\overline{R}) + P(R\overline{R}\overline{R}\overline{R}\overline{R})\right) = 1 - \frac{\binom{20}{5}}{\binom{26}{5}} - \frac{\binom{6}{1} \cdot \binom{20}{4}}{\binom{26}{5}} \approx 0{,}322.$

D3a $P(\text{minstens twee 6}) = 1 - P(\text{geen of één 6}) = 1 - P(\overline{6}\,\overline{6}\,\overline{6}\,\overline{6}\,\overline{6}\,\overline{6}\,\overline{6}\,\overline{6}) - P(\underline{6\,\overline{6}\,\overline{6}\,\overline{6}\,\overline{6}\,\overline{6}\,\overline{6}\,\overline{6}}) = 1 - \left(\frac{5}{6}\right)^8 - \binom{8}{1}\cdot\frac{1}{6}\cdot\left(\frac{5}{6}\right)^7 \approx 0{,}395.$

```
1-(5/6)^8-8 nCr 1*1/6*(5/6)^7
            .3953230977
1-binomcdf(8,1/6,1)
            .3953230977
```

D3b $P(\underline{\underline{33444(5\text{of}6)(5\text{of}6)(5\text{of}6)}}) = \binom{8}{2}\cdot\binom{6}{3}\cdot\left(\frac{1}{6}\right)^2\cdot\left(\frac{1}{6}\right)^3\cdot\left(\frac{2}{6}\right)^3 \approx 0{,}003.$

```
8 nCr 2*6 nCr 3*(1/6)^5*(2/6)^3
            .0026672763
```

D4a $\frac{2}{5}\cdot\frac{1}{6}\cdot\frac{3}{7} + 4\cdot\frac{1}{5}\cdot\frac{4}{7} = \frac{6}{210} + \frac{16}{35} = \frac{1}{35} + \frac{16}{35} = \frac{17}{35}.$

```
2/5*1/6*3/7+4*1/5*4/7▸Frac
                  17/35
```

D4b $\left(\frac{3}{8}\right)^2 + 3\cdot\frac{1}{8}\cdot\frac{5}{8} = \frac{3}{8}\cdot\frac{3}{8} + \frac{15}{64} = \frac{9}{64} + \frac{15}{64} = \frac{24}{64} = \frac{3}{8}.$

```
(3/8)²+3*1/8*5/8▸Frac
                    3/8
```

D4c $5\cdot\frac{1}{6} + 1\frac{1}{6} + \frac{5}{\frac{6}{11}} = \frac{5}{6} + 1\frac{1}{6} + 5\cdot\frac{11}{6} = 2 + \frac{55}{6} = 2 + 9\frac{1}{6} = 11\frac{1}{6}.$

```
5*1/6+1+1/6+5/(6/11)▸Frac
                   67/6
```

D5a $5 + \frac{3}{a} = 5\cdot\frac{a}{a} + \frac{3}{a} = \frac{5a}{a} + \frac{3}{a} = \frac{5a+3}{a}.$

D5c $\frac{4}{a} + \frac{8-a}{5} = \frac{4\cdot 5}{a\cdot 5} + \frac{(8-a)\cdot a}{5\cdot a} = \frac{20+8a-a^2}{5a} = \frac{-a^2+8a+20}{5a}.$

D5b $\frac{a-3}{a}\cdot\frac{5-a}{4} = \frac{(a-3)\cdot(5-a)}{4a} = \frac{5a-a^2-15+3a}{4a} = \frac{-a^2+8a-15}{4a}.$

D6a $P(rr) = \frac{x}{10}\cdot\frac{x+2}{15} = \frac{x\cdot(x+2)}{10\cdot 15} = \frac{x^2+2x}{150}.$

D6b $P(\underline{\underline{rw}}) = P(rw) + P(wr) = \frac{x}{10}\cdot\frac{15-(x+2)}{15} + \frac{10-x}{10}\cdot\frac{x+2}{15} = \frac{x\cdot(13-x)}{150} + \frac{(10-x)\cdot(x+2)}{150}$

$= \frac{13x - x^2 + 10x + 20 - x^2 - 2x}{150} = \frac{-2x^2+21x+20}{150}.$

```
Plot1 Plot2 Plot3
\Y1=(-2X²+21X+20)/150
\Y2=0.45
\Y3=
```

X	Y1	Y2
3	.43333	.45
4	.48	.45
5	.5	.45
6	.49333	.45
7	.46	.45
8	.4	.45
9	.31333	.45

X=7

D6c $P(\underline{\underline{rw}}) = \frac{-2x^2+21x+20}{150} > 0{,}45$ (TABLE) $\Rightarrow x = 4 \vee x = 5 \vee x = 6 \vee x = 7.$
Er zitten dus in vaas I en vaas II respectievelijk 4 en 6 of 5 en 7 of 6 en 8 of 7 en 9 rode knikkers.

D7a $P(\overline{w}w) = \frac{5}{a}\cdot\frac{a-5}{a-1} = \frac{5\cdot(a-5)}{a\cdot(a-1)} = \frac{5a-25}{a^2-a}.$

D7b $P(\overline{w}\,\overline{w}w) = \frac{5}{a}\cdot\frac{4}{a-1}\cdot\frac{a-5}{a-2} > 0{,}15$ (TABLE) $\Rightarrow a = 6 \vee a = 7 \vee a = 8 \vee a = 9.$

```
Plot1 Plot2 Plot3
\Y1=5/X*4/(X-1)*(X-5)/(X-2)
\Y2=0.15
\Y3=
```

X	Y1	Y2
4	-.8333	.15
5	0	.15
6	.16667	.15
7	.19048	.15
8	.17857	.15
9	.15873	.15
10	.13889	.15

X=10

D8a $P(AAAAAAAAA\overline{A}) = 0{,}78^9\cdot(1-0{,}78) = 0{,}78^9\cdot 0{,}22 \approx 0{,}024.$

```
0.78^9*0.22
           .0235111626
```

D8b $P(A \geq 9) = 1 - P(A \leq 8) = 1 - \text{binomcdf}(10, 0.78, 8) \approx 0{,}318.$ (A = het aantal keer dat hij alles omver werpt)
OF: $P(A \geq 9) = P(A = 9) + P(A = 10) = \text{binompdf}(10,0.78,9) + \text{binompdf}(10,0.78,10) \approx 0{,}318.$

```
1-binomcdf(10,0.78,8)
            .3184693845
binompdf(10,0.78,9)+binompdf(10,0.78,10)
            .3184693843
```

D9a $P(A = 5) = \text{binompdf}(15, 0.36, 5) \approx 0{,}209.$

```
binompdf(15,0.36,5)
            .2093474021
```

D9b $P(X \leq 10) = \text{binomcdf}(15, 0.36 + 0.21, 10) \approx 0{,}845.$ (X = het aantal keer "A of C")

```
binomcdf(15,0.36+0.21,10)
            .8454482532
```

D9c $P(X = 8 \text{ of } X = 9) = \text{binompdf}(15, 0.36+0.21, 8) + \text{binompdf}(15, 0.36+0.21, 9) \approx 0{,}396.$

```
binompdf(15,0.57,8)+binompdf(15,0.57,9)
            .395856852
```

D9d $P(C = 0) = \text{binompdf}(15, 0.21, 0) \approx 0{,}029.$

```
binompdf(15,0.21,0)
            .0291344195
```

D10a $P(E > 10) = 1 - P(E \leq 10) = 1 - \text{binomcdf}(16, \frac{1}{2}, 10) \approx 0{,}105.$

D10b $P(Z < 3) = P(Z \leq 2) = \text{binomcdf}(16, \frac{1}{6}, 2) \approx 0{,}487.$

```
1-binomcdf(16,1/2,10)
            .1050567627
binomcdf(16,1/6,2)
            .4867910368
```

D10c $P(5 < X < 10) = P(X \leq 9) - P(X \leq 5) = \text{binomcdf}(16, \frac{2}{6}, 9) - \text{binomcdf}(16, \frac{2}{6}, 5) \approx 0{,}437.$ (X = het aantal keer "1 of 2")

```
binomcdf(16,2/6,9)-binomcdf(16,2/6,5)
            .4371183582
```

D11a $P(V > 10) = 1 - P(V \leq 10) = 1 - \text{binomcdf}(20, 0.42, 10) \approx 0{,}170.$

```
1-binomcdf(20,0.42,10)
            .1704868869
```

D11b $P(\underline{\underline{aaaaaaaaaavvvvvvvvvv}}) = \binom{20}{10}\cdot 0{,}51^{10}\cdot 0{,}42^{10} \approx 0{,}038.$ (niet binomiaal !!!, want $0{,}51 + 0{,}42 \neq 1$)

```
20 nCr 10*0.51^10*0.42^10
            .0375658497
```

D12 $P(T \geq 5) = 1 - P(T \leq 4) = 1 - \text{binomcdf}(n, \frac{3}{36}$ (zie rooster op voorblad)$, 4) > 0{,}90$ (TABLE) $\Rightarrow n \geq 94.$
Dus minstens 94 keer gooien. (door de tabel bladeren kost wel even wat tijd)

```
Plot1 Plot2 Plot3
\Y1=1-binomcdf(X,3/36,4)
\Y2=0.90
\Y3=
```

X	Y1	Y2
92	.89014	.9
93	.89545	.9
94	.90053	.9
95	.9054	.9
96	.91006	.9
97	.91451	.9
98	.91877	.9

X=94

D13 $p = P(L > 7) = \text{normalcdf}(7, 10^{99}, 8, 1.3) \approx 0{,}779\ldots$ en $P(X = 5) = \text{Ans}^5 \approx 0{,}287.$
OF: $P(X = 5) = \text{binompdf}(5, \text{Ans}, 5) \approx 0{,}287.$

```
normalcdf(7,10^99,8,1.3)
            .7791219069
Ans^5
            .2870959584
```

```
normalcdf(7,10^99,8,1.3)
            .7791219069
binompdf(5,Ans,5)
            .2870959584
```

D14 $P(U = 100) = P(18 \text{ ogen}) = P(666) = (\frac{1}{6})^3 = \frac{1}{216}.$

$P(U = 15) = P(17 \text{ ogen}) = P(\underline{\underline{665}}) = \binom{3}{2}\cdot(\frac{1}{6})^2\cdot\frac{1}{6} = 3\cdot(\frac{1}{6})^3 = \frac{3}{216}.$

```
6^3
                    216
3 nCr 2
                      3
```

$P(U = 5) = P(16 \text{ ogen}) = P(\underline{\underline{664}}) + P(\underline{\underline{655}}) = \binom{3}{2}\cdot(\frac{1}{6})^2\cdot\frac{1}{6} + \binom{3}{1}\cdot\frac{1}{6}\cdot(\frac{1}{6})^2 = 6\cdot(\frac{1}{6})^3 = \frac{6}{216}.$

u	100	15	5	0
$P(U=u)$	$\frac{1}{216}$	$\frac{3}{216}$	$\frac{6}{216}$	...

$E(U) = 100\cdot\frac{1}{216} + 15\cdot\frac{3}{216} + 5\cdot\frac{6}{216} + 0\cdot\ldots = \frac{175}{216} \approx 0{,}81$ (€).
De winstverwachting per spel is $E(W) = E(U) - 1 \approx -0{,}19$ (€).

```
100*1+15*3+5*6
                    175
Ans/216
            .8101851852
Ans-1
           -.1898148148
```

D15a $E(X) = 6{,}35$ en $\sigma_X \approx 2{,}20$ (1-Var Stats L1,L2).

D15b $E(T) = E(X) + E(Y) = 6{,}35 + 5{,}89 = 12{,}24$.

$\sigma_T = \sqrt{(\sigma_X)^2 + (\sigma_Y)^2} \approx \sqrt{2{,}20^2 + 1{,}84^2} \approx 2{,}87$.

Gemengde opgaven 11. Kansverdelingen

G22a $P(\text{mm}) = \frac{x}{30} \cdot \frac{x-1}{29} > 0{,}3$ (TABLE) $\Rightarrow x = 7 \vee x = 8 \vee ... \vee x = 30$.
Dus er zijn minstens 17 meisjes in de klas van 30 leerlingen.

G22b $P(\text{mmj}) = \frac{x}{30} \cdot \frac{x-1}{29} \cdot \frac{30-x}{28}$ (TABLE) $\Rightarrow P(\text{mmj})$ is maximaal 0,156 voor $x = 20$.
Deze kans is maximaal 0,156 als er 20 meisjes en 10 jongens in de klas zitten.

G23a $p = P(6) = \frac{1}{6}$ en $P(A > 2) = 1 - P(A \le 2) = 1 - \text{binomcdf}(10, \frac{1}{6}, 2) \approx 0{,}225$.

G23b $p = P(som > 9) = \frac{6}{36}$ (zie het rooster) en $P(B \ge 4) = 1 - P(B \le 3) = 1 - \text{binomcdf}(12, \frac{6}{36}, 3) \approx 0{,}125$.

+	1	2	3	4	5	6
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

G23c $p = P(som \le 5) = P(som = 3 \text{ of } som = 4 \text{ of } som = 5) = P(111) + P(\underline{\underline{11}}2) + P(\underline{\underline{11}}3) + P(\underline{\underline{12}}2)$

$= (\frac{1}{6})^3 + \binom{3}{2} \cdot (\frac{1}{6})^3 + \binom{3}{2} \cdot (\frac{1}{6})^3 + \binom{3}{1} \cdot (\frac{1}{6})^3 = \frac{1}{216} + \frac{3}{216} + \frac{3}{216} + \frac{3}{216} = \frac{10}{216}$.

De gevraagde kans is $P(C \le 2) = \text{binomcdf}(20, \frac{10}{216}, 2) \approx 0{,}937$.

G23d $p = P(1) = \frac{1}{6}$ en $P(D \ge 3) = 1 - P(D \le 2) = 1 - \text{binomcdf}(n, \frac{1}{6}, 2) > 0{,}95$ (TABLE) $\Rightarrow n \ge 36$.
Dus minstens 36 keer gooien.

G23e $p = P(\text{minstens één 6}) = \frac{11}{36}$ (zie de grijze vakjes in het rooster) of $1 - P(\text{geen 6}) = 1 - P(\bar{6}\bar{6}) = 1 - (\frac{5}{6})^2$.

$P(---+) = (\frac{25}{36})^3 \cdot \frac{11}{36} \approx 0{,}102$.

G24a R = het aantal reizigers; $P(R \le 1250) = \text{binomcdf}(1350, 0.92, 1250) \approx 0{,}802$.

G24b $P(R > 1250) = 1 - P(R \le 1250) = 1 - \text{binomcdf}(n, 0.92, 1250) \le 0{,}05$ (TABLE) $\Rightarrow n \le 1341$.
Dus maximaal 1341 zitplaatsen verkopen. (het bladeren door de tabel is erg tijdrovend)

G25a $E(U) = 5000 \times \frac{1}{10000} + 1000 \times \frac{2}{10000} + 50 \times \frac{7}{10000} + 5 \times \frac{490}{10000} = 0{,}98$ (€).
$E(W) = E(U) - 2{,}50 = 0{,}98 - 2{,}50 = -1{,}52$ (€).

u	5000	1000	50	5	0
$P(U = u)$	$\frac{1}{10000}$	$\frac{2}{10000}$	$\frac{7}{10000}$	$\frac{490}{10000}$	...

G25b $P(\text{minstens één prijs}) = 1 - P(\text{geen prijs}) = 1 - \frac{\binom{9500}{7}}{\binom{10000}{7}} \approx 0{,}302$.

G25c $P(\text{minstens één prijs}) = 1 - P(\text{geen prijs}) = 1 - \frac{\binom{9500}{14}}{\binom{10000}{14}} \approx 0{,}513 \ne 2 \cdot 0{,}302$.

G25d $P(\text{minstens één prijs}) = 1 - P(\text{geen prijs}) = 1 - \frac{\binom{9500}{n}}{\binom{10000}{n}} > 2 \cdot \left(1 - \frac{\binom{9500}{7}}{\binom{10000}{7}}\right)$ (TABLE) $\Rightarrow n \ge 19$.

Dus Amalia moet minstens 19 loten kopen.

G26a $P(U = 1) = P(\underline{\underline{++-}}) = \frac{\binom{3}{2} \cdot \binom{77}{18}}{\binom{80}{20}} \approx 0{,}139$ of $P(\underline{\underline{++-}}) = \frac{\binom{20}{2} \cdot \binom{60}{1}}{\binom{80}{3}} \approx 0{,}139$.

u	1	43	0
$P(U = u)$	0,139	0,014	...

G26b $P(U = 43) = P(+++) = \frac{\binom{3}{3} \cdot \binom{77}{17}}{\binom{80}{20}} \approx 0{,}014$ of $P(+++) = \frac{\binom{20}{3}}{\binom{80}{3}} \approx 0{,}014$.

$E(U) \approx 1 \cdot 0{,}139 + 43 \cdot 0{,}014 \approx 0{,}74$ (\$) $\Rightarrow E(W) \approx 0{,}74 - 1 = -0{,}26$ (\$).

G26c $P(U = 12) = P(++) = \frac{\binom{2}{2} \cdot \binom{78}{18}}{\binom{80}{20}} \approx 0{,}060$ of $P(++) = \frac{\binom{20}{2}}{\binom{80}{2}} \approx 0{,}060$.

u	12	0
$P(U = u)$	0,060	...

$E(U) \approx 12 \cdot 0{,}060 = 0{,}72$ (\$) $\Rightarrow E(W) \approx 0{,}72 - 1 = -0{,}28$ (\$).

G27a De kosten zijn: $4 \cdot 2 + 8 = 16$ (€); $P(\text{neg.}) = \left(\frac{19}{20}\right)^4 = 0{,}95^4 \approx 0{,}8145$.

k	16	48
$P(K = k)$	0,8145	0,1855

G27b $P(\text{pos.}) = 1 - P(\text{negatief}) = 1 - 0{,}95^4 \approx 0{,}1855$; de kosten zijn dan: 16 (zie 27a) $+ 4 \cdot 8 = 48$ (€).

G27c $E(K) = 16 \cdot 0{,}95^4 + 48 \cdot \left(1 - 0{,}95^4\right)$ (€) $\Rightarrow$ per monster $E = \frac{E(k)}{4} \approx 5{,}48$ (€).

G27d $P(\text{neg.}) = 0{,}95^5$ met kosten $5 \cdot 2 + 8 = 18$ (€) en $P(\text{pos.}) = 1 - 0{,}95^5$ met kosten $18 + 5 \cdot 8 = 58$ (€).
$E(K) = 18 \cdot 0{,}95^5 + 58 \cdot \left(1 - 0{,}95^5\right)$ (€) $\Rightarrow$ per monster $E = \frac{E(k)}{5} \approx 5{,}41$ (€).

G27e $P(\text{neg.}) = 0{,}95^n$ met kosten $n \cdot 2 + 8 = 2n + 8$ (€) en $P(\text{pos.}) = 1 - 0{,}95^n$ met kosten $2n + 8 + n \cdot 8 = 10n + 8$ (€).
$E(K) = (2n+8) \cdot 0{,}95^n + (10n+8) \cdot \left(1 - 0{,}95^n\right) = 2n \cdot 0{,}95^n + \cancel{8 \cdot 0{,}95^n} + 10n - 10n \cdot 0{,}95^n + 8 - \cancel{8 \cdot 0{,}95^n}$
$= 10n - 8n \cdot 0{,}95^n + 8$ (€) $\Rightarrow$ per monster $E = \frac{E(k)}{n} = 10 - 8 \cdot 0{,}95^n + \frac{8}{n}$ (€).

G27f $E = 10 - 8 \cdot 0{,}95^n + \frac{8}{n}$ (TABLE) $\Rightarrow E$ is minimaal voor $n = 5$.

G28a $P(U = 5000) = P(\underline{\underline{wwwww}}\bar{w}r) = P(\underline{\underline{wwwww}}\bar{w}) \cdot P(r) = \frac{\binom{5}{4} \cdot \binom{40}{1}}{\binom{45}{5}} \cdot \frac{1}{45} \approx 3{,}63774 \cdot 10^{-6} = \frac{1}{x} \Rightarrow x \approx 274896$.

G28b Het zou wel 1 op 45 zijn als het alleen om de rode bal in de tweede trommel zou gaan.
$P(U = 1) = P(\bar{w}\bar{w}\bar{w}\bar{w}\bar{w}r) = P(\bar{w}\bar{w}\bar{w}\bar{w}\bar{w}) \cdot P(r) = \frac{\binom{40}{5}}{\binom{45}{5}} \cdot \frac{1}{45} \approx 0{,}011968... = \frac{1}{x} \Rightarrow x \approx 84$. (dus de onderste regel klopt wel)

G28c Er werden $\frac{190 \text{ miljoen}}{0{,}3082} \approx 616{,}48$ miljoen formulieren ingevuld in deze 16 trekkingen.

G28d $E(U) = 100000 \times \frac{1}{1249526} + 5000 \times \frac{1}{274896} + 100 \times \frac{1}{6248} + 100 \times \frac{1}{7049} + 5 \times \frac{1}{160} + 5 \times \frac{1}{556} + 2 \times \frac{1}{120} + 1 \times \frac{1}{84} \approx 0{,}1972$ (\$).
De inzet per lot is 1 (\$). Dus de uitbetaling is 19,72%.

G28e $P(\text{een prijs bij een trekking}) = \frac{1}{54979155} + \frac{1}{1249526} + \frac{1}{274896} + \frac{1}{6248} + \frac{1}{7049} + \frac{1}{160} + \frac{1}{556} + \frac{1}{120} + \frac{1}{84} = p$.
$P(\text{geen prijs bij een trekking}) = 1 - p$.
$P(\text{meer dan één keer eenprijs bij 104 trekkingen})$
$= 1 - P(\text{geen prijs bij 104 trekkingen}) - P(\text{één prijs bij 104 trekkingen})$
$= 1 - (1-p)^{104} - \binom{104}{1} \cdot p \cdot (1-p)^{103} \approx 0{,}801$.

G29a $P(J = 2) = \text{binompdf}(4, 0.5, 2) = 0{,}375$ of $P(J = 2) = P(\underline{\underline{jjmm}}) = \binom{4}{2} \cdot 0{,}5^2 \cdot 0{,}5^2 = 0{,}375$.
$P(J = 2) = \text{binompdf}(4, 0.51, 2) \approx 0{,}3747$ of $P(J = 2) = P(\underline{\underline{jjmm}}) = \binom{4}{2} \cdot 0{,}51^2 \cdot 0{,}49^2 \approx 0{,}3747$.
De kansen verschillen ongeveer 0,0003.

G29b $P(J \geq 285) = 1 - P(J \leq 284) = 1 - \text{binompdf}(500, 0.51, 284) \approx 0{,}0041$.

G29c $P(\text{jongen bij zeer dominante moeder}) = 0{,}75 \Rightarrow P(\text{meisje bij zeer dominante moeder}) = 1 - 0{,}75 = 0{,}25$.
Dan zou $P(\text{meisje bij zeer meegaande moeder}) = 5 \cdot 0{,}25 = 1{,}25 > 1$ en dat kan niet.

G29d Stel $P(\text{meisje bij zeer meegaande moeder}) = 0{,}75 \Rightarrow P(\text{jongen bij zeer meegaande moeder}) = 1 - 0{,}75 = 0{,}25$.
Er geldt dan $P(\text{meisje bij zeer dominante moeder}) = \frac{1}{5} \cdot 0{,}75 = 0{,}15 \Rightarrow P(\text{jongen bij zeer dominante moeder}) = 1 - 0{,}15 = 0{,}85$.
NIET geldt: $P(\text{jongen bij zeer dominante moeder}) = 5 \cdot P(\text{jongen bij zeer meegaande moeder})$, want $0{,}85 \neq 5 \cdot 0{,}25$.

TI-84 12. De binomiale verdeling

1a $P(X = 8) = \text{binompdf}(18, 0.38, 8) \approx 0{,}160$.

1b $P(X = 4) = \text{binompdf}(18, 0.38, 4) \approx 0{,}079$.

1c $P(X = 3) + P(X = 4) = \text{binompdf}(18, 0.38, 3) + \text{binompdf}(18, 0.38, 4) \approx 0{,}114$.
OF: $P(X = 3) + P(X = 4) = P(X \leq 4) - P(X \leq 2)$
$= \text{binomcdf}(18, 0.38, 4) - \text{binomcdf}(18, 0.38, 2) \approx 0{,}114$.

1d $P(X \leq 5) = \text{binomcdf}(18, 0.38, 5) \approx 0{,}262$.

1e $1 - P(X \leq 6) = 1 - \text{binomcdf}(18, 0.38, 6) \approx 0{,}558$.

1f $P(X \leq 6) - P(X \leq 2) = \text{binomcdf}(18, 0.38, 6) - \text{binomcdf}(18, 0.38, 2) \approx 0{,}430$.