

Havo wiskunde d

Kansen 2

de **Wageningse**  
**Method**



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†

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**ISBN**  
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<b>4</b>	<b>Kansen_2</b>	<b>5</b>
	<b>Antwoorden</b>	<b>75</b>
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## Overzicht iconen . . .



Theorie



Voorbeeld



Opmerking



Historie



Werkblad



Computer



Echt, moet kunnen



Puzzelen



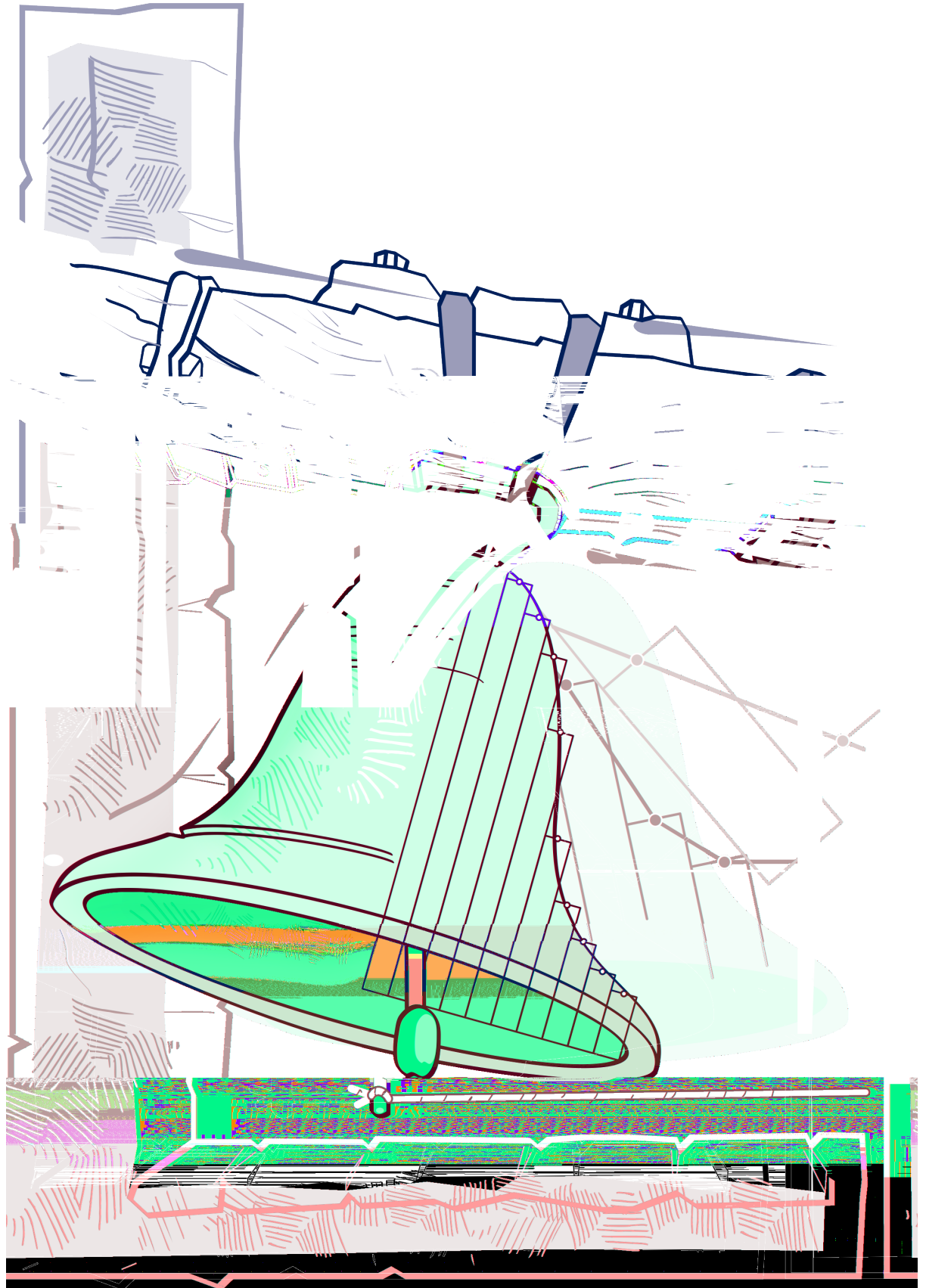
Pittig



Hint



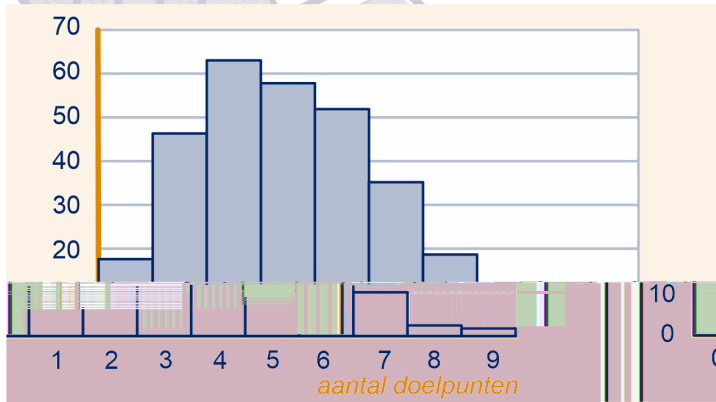
Facultatief



# 4.1 Normaal of niet

1

306  
verdeeld over het aantal doelpunten



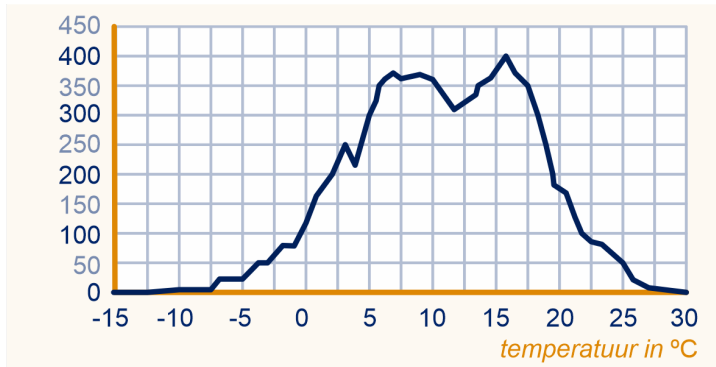
a

b

2

8 9

7305



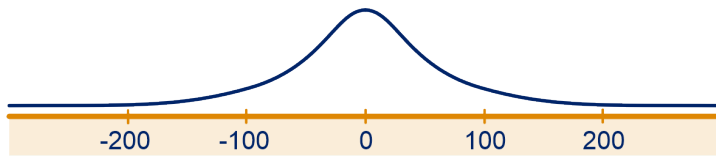
a

b



# 4.1 Normaal of niet

3



a

100

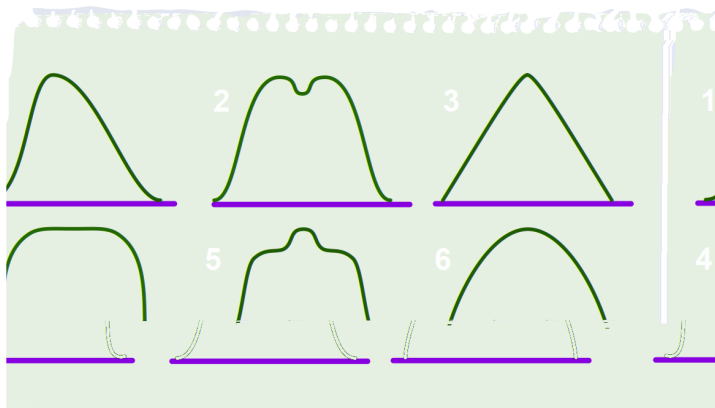
b

*klokvormige*

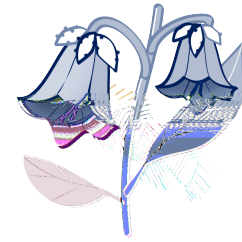
*Klokvormig*



4



# 4.1 Normaal of niet



kening

kansre-

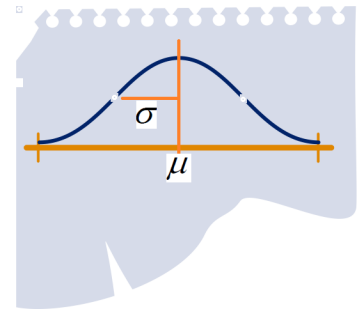
standaardnormale kromme

= 0

= 1

mu

sigma



wijking

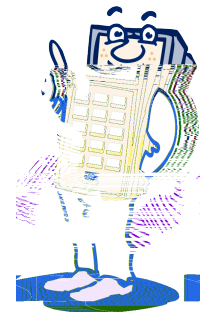
standaardaf-

0

1

5

a



b

$$y = 2^{-x^2}$$

$$y = 2^{-x^2}$$

c

$$y = 0,4 \cdot 2^{-0,72x^2}$$

0,4    -0,72

buigpunten van de grafiek  
oppervlakte

1

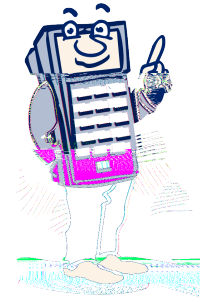
1

# 4.1 Normaal of niet

6

$$= 10$$

$$\begin{aligned} 18 \\ = 182 \end{aligned}$$



normale verdeling

7

$$= 5 \quad = 3$$

a

$$-4 \leq x \leq 12 \quad 0 \leq y \leq \frac{1}{2}$$

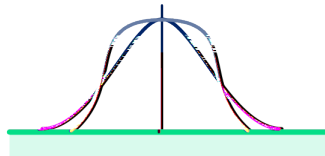
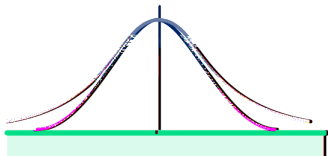
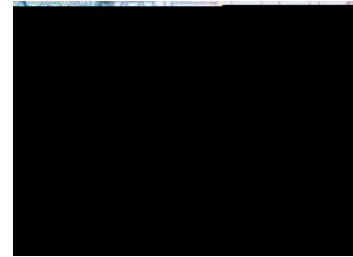
b

$$= 5 \quad = 6 \quad = 7$$

c

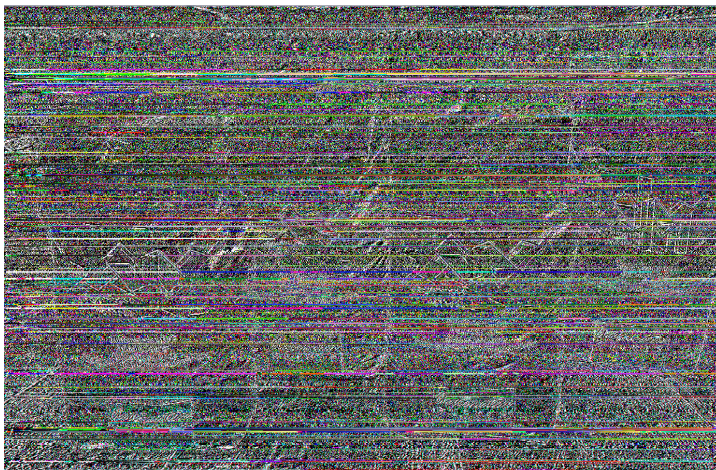
8

# 4.1 Normaal of niet



9

1000



# 4.1 Normaal of niet

		1000			
		1000		500	
4					
gewicht	aantal	gewicht	aantal	gewicht	aantal
970 - 974	1	990 - 994	62	1010 - 1014	40
974 - 978	6	994 - 998	71	1014 - 1018	21
978 - 982	12	998 - 1002	79	1018 - 1022	11
982 - 986	23	1002 - 1006	73	1022 - 1026	5
986 - 990	35	1006 - 1010	59	1026 - 990	2

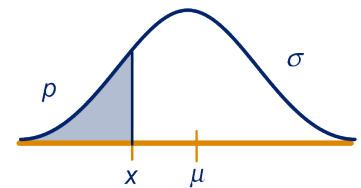
a

b

c

d

e



= 1000

990 1010

980 1020

68

= 80

= 6

68

74 86

68 990

1010

= 10

a

= 1000      = 10

990      1010      0,6827

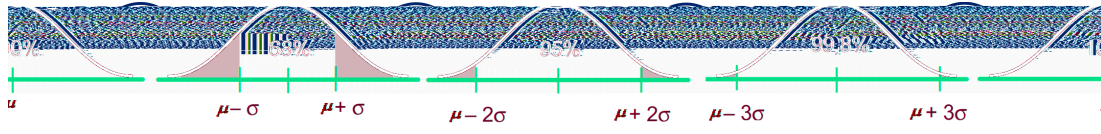


10

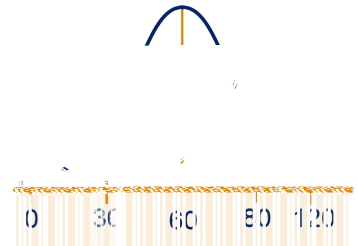


# 4.1 Normaal of niet

1 100



## Opmerking



“Hoeveel procent ligt onder ... / boven ... / tussen ... en ...”

## Opmerking

$$\begin{aligned}
 &1 \\
 &= 1000 \qquad X \qquad = 10 \\
 &\qquad\qquad\qquad 987 \qquad 1002 \\
 &(987 < X < 1002) \quad = 1000; \quad = 10)
 \end{aligned}$$

$$\begin{aligned}
 &103.370 \qquad 18 \\
 &\qquad\qquad\qquad 181,8
 \end{aligned}$$

$$\begin{aligned}
 &7 \\
 &\qquad\qquad\qquad 190
 \end{aligned}$$

a

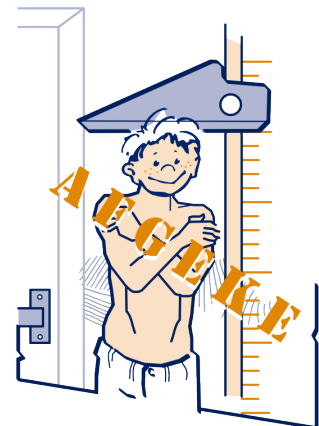
b

$$190$$

$$200$$

$$160$$

c



14

15





# 4.1 Normaal of niet

c



1

1

15

30

a

b

30

2

c

1980

19

# 4.1 Normaal of niet

20



= 100

- a
- b
- c

21

= 15

60.000

= 90

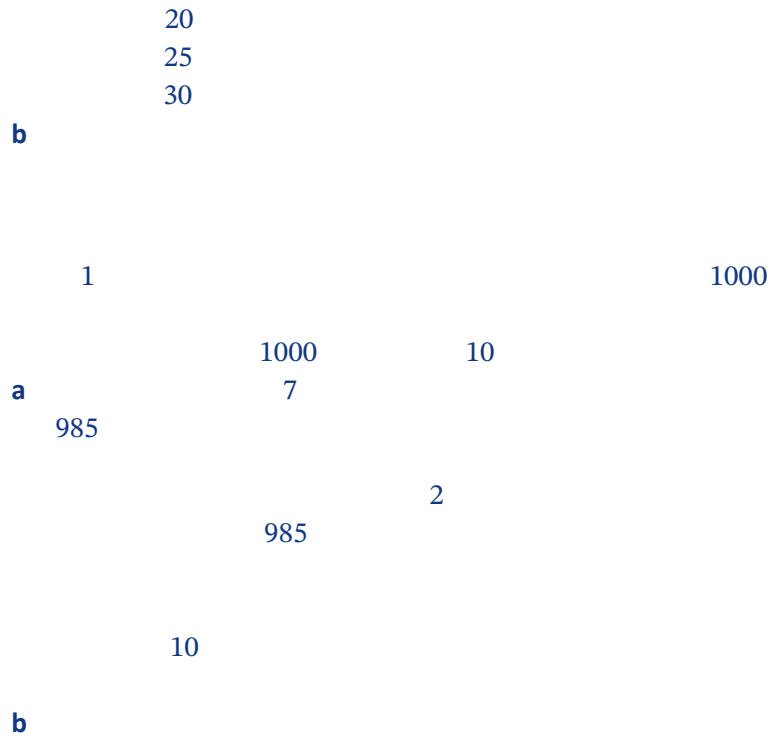


70  
70 100  
100

- a

## 4.1 Normaal of niet

22



## 4.2 Het bord van Galton

23



a

b

c

d

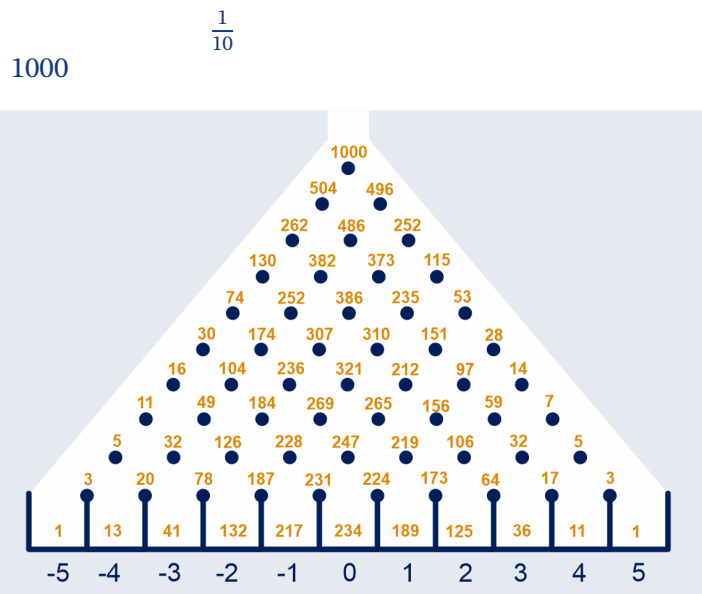
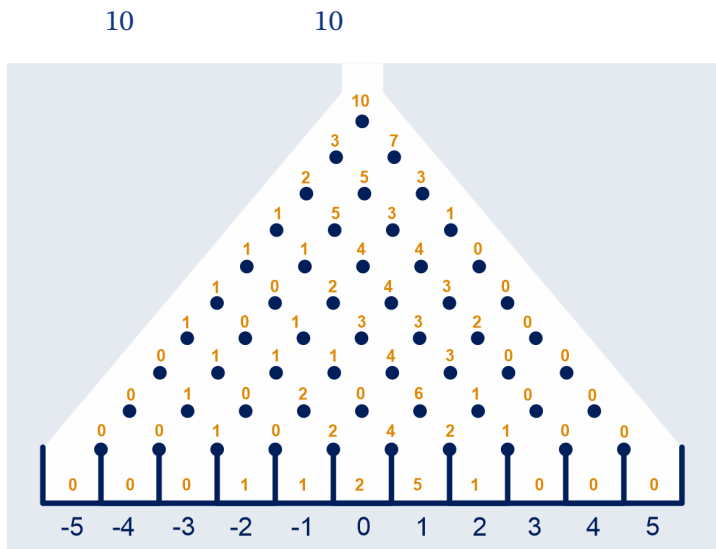
## 4.2 Het bord van Galton

24

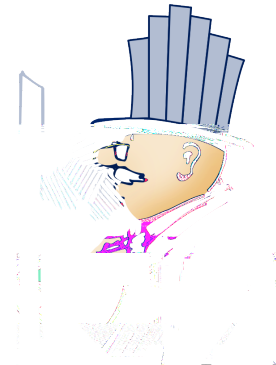
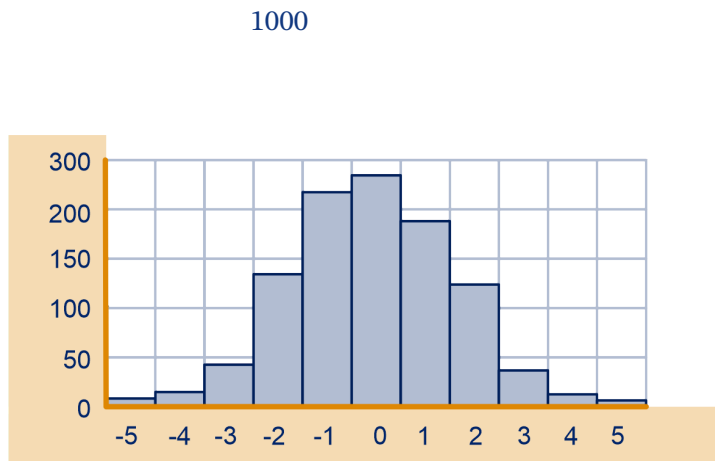


25

Bord van Galton Kansrekenen..



## 4.2 Het bord van Galton

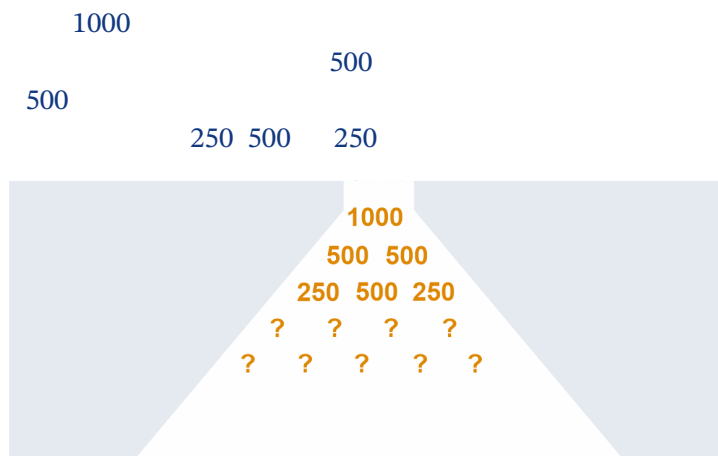


26

a 1000

b

27

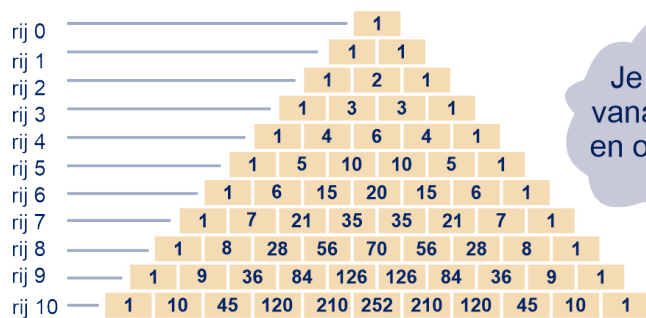


a

b 1000

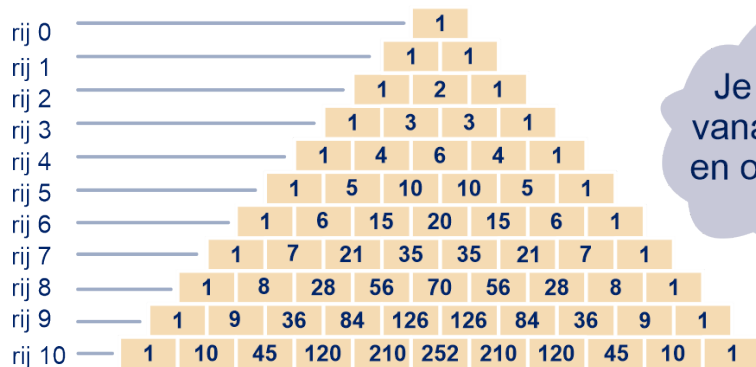
## 4.2 Het bord van Galton

1024



Je moet de rijen vanaf 0 nummeren en ook de plaatsen op een rij.

c



Je moet de rijen vanaf 0 nummeren en ook de plaatsen op een rij.

$$\text{combinatiegetal} \binom{10}{3}.$$

28

1024

a  
b

29

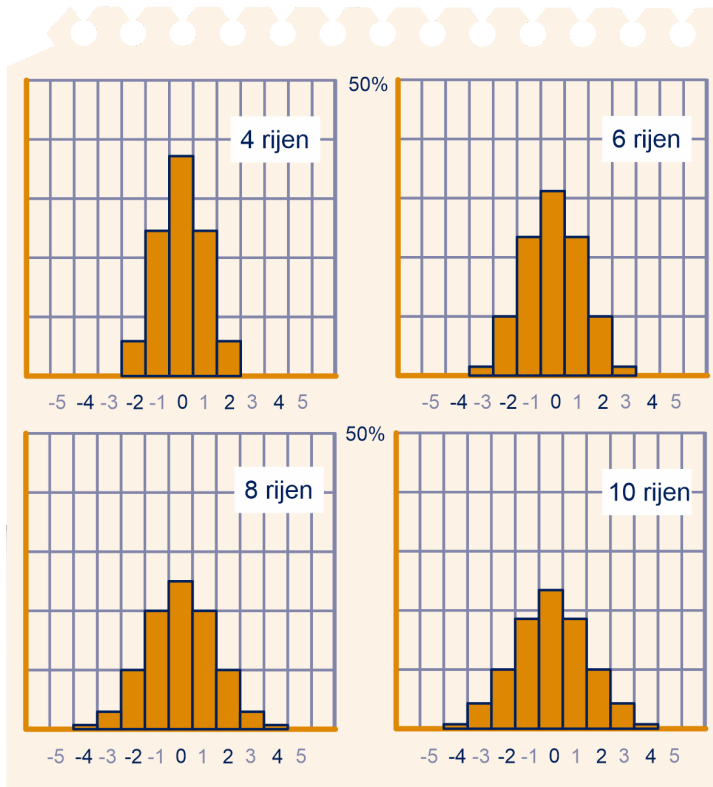
a

b

## 4.2 Het bord van Galton

30

*oneven*



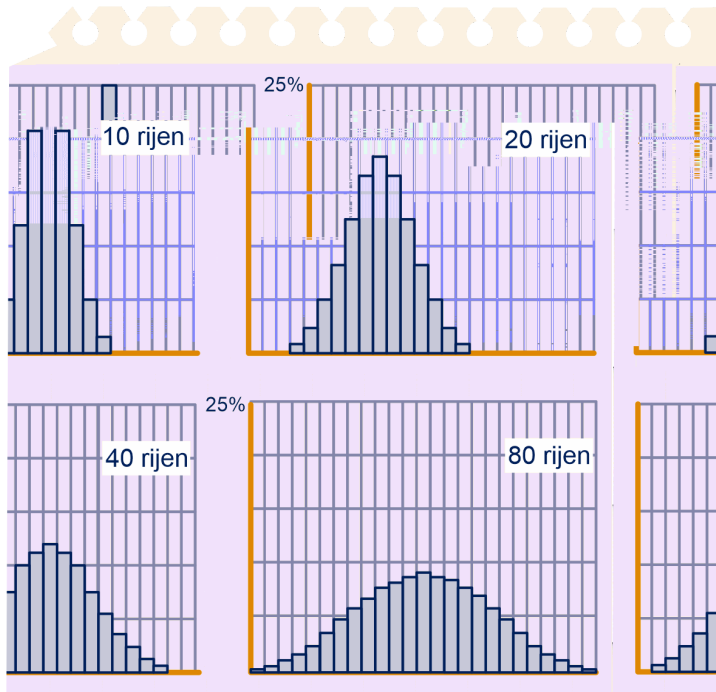
8

0

$$\frac{1}{2}\sqrt{n} \quad n \quad \frac{1}{2}\sqrt{n}$$
$$\frac{1}{2}\sqrt{n} \quad -\frac{1}{2}\sqrt{n}$$



## 4.2 Het bord van Galton



31



- a  $= \frac{1}{2}\sqrt{n}$     40            80
- b                            40            80
- c

32



- 16            64
- 64            16
- a                            16
- b                            20            80
- c                            *Binomiaal of Normaal*

20

20

33

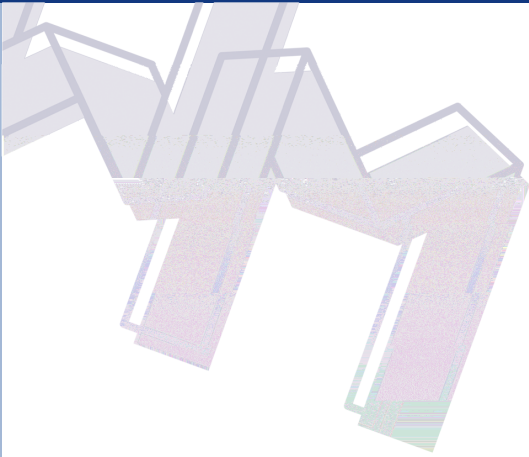
a

b

*toevals*

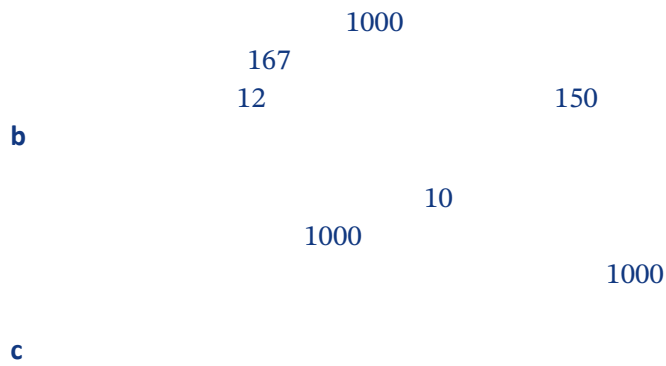
# 4.3 de z-waarde

34

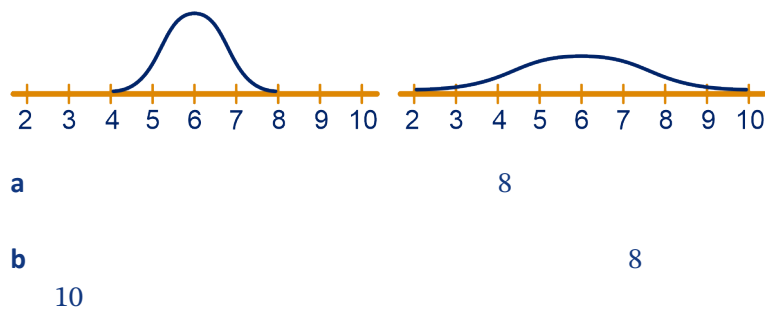


35

16,6  
20,1  
a



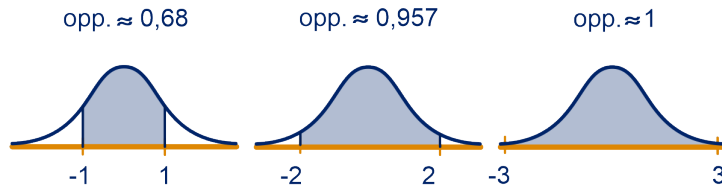
36





# 4.3 de z-waarde

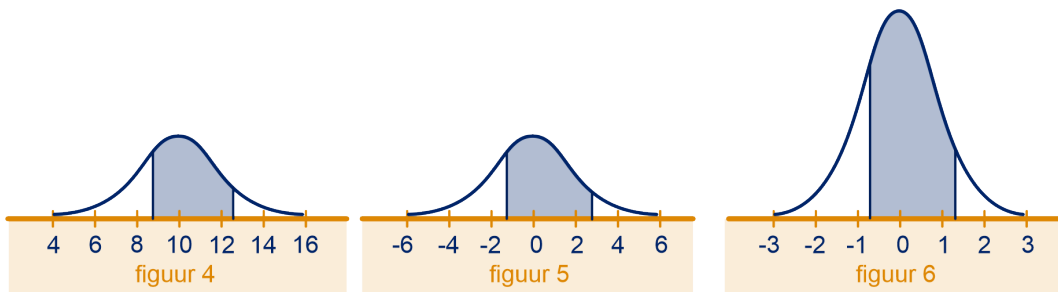
39



40



a



b

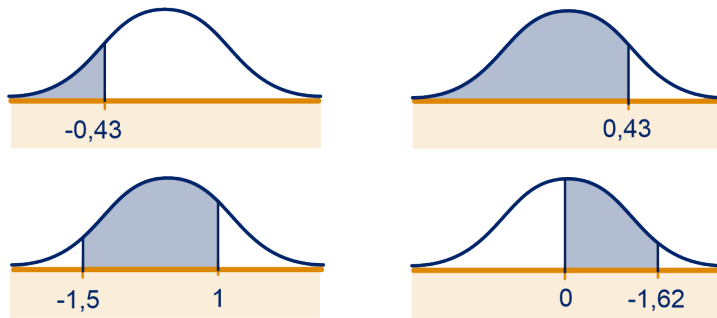
$x$	$X$	$\frac{x-10}{2}$	$z$
c	8,6	12,6	
d	-1,4	12,6	
e	-0,7	6,3	

# 4.3 de z-waarde

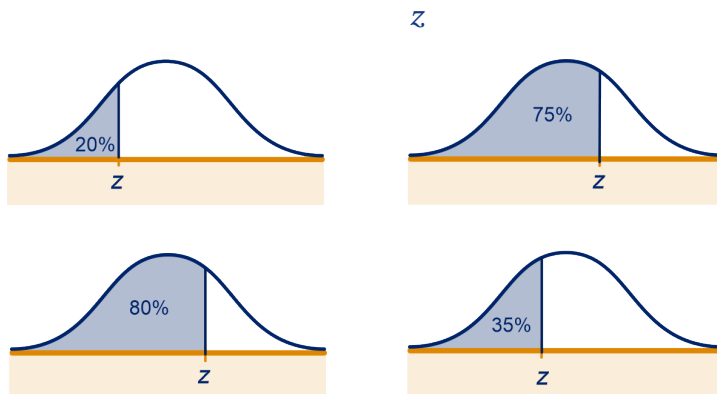


$$\begin{aligned}
 X &= 2 & \frac{X - 10}{2} &= 1 \\
 &= 0 & &= 1
 \end{aligned}$$

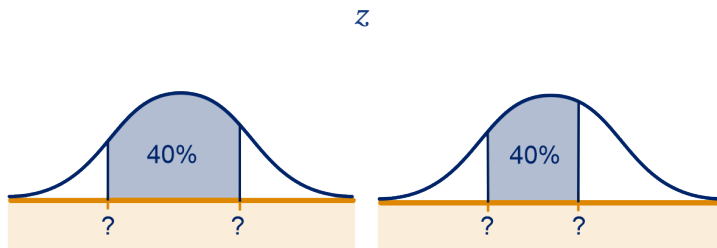
41



42



43



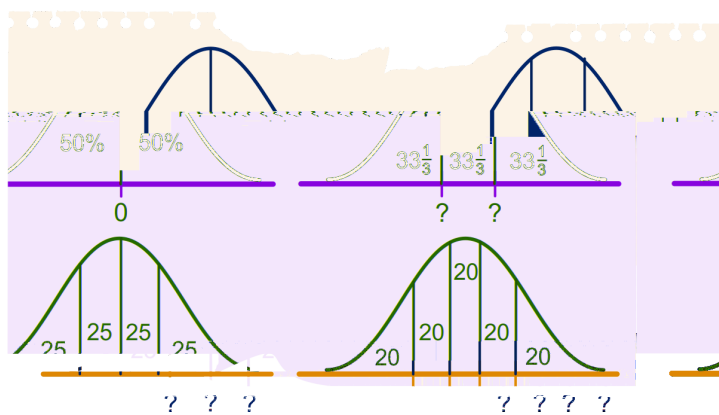
- a        z
- b        z

# 4.3 de z-waarde

44

			56
		8	
			42
		6	
a			60
			45
b			
	60		

45



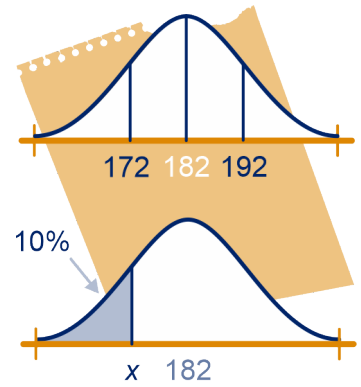
# 4.4 De vier typen

46

a 182 10 200

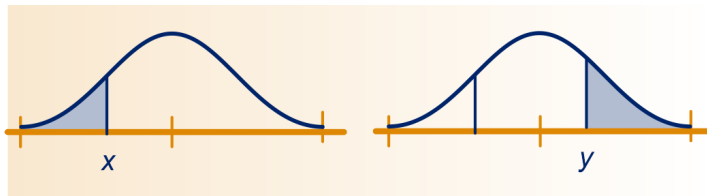
Hoe lang is de kortste 10 procent jongens? Een bijbehorend plaatje staat hiernaast. Gevraagd wordt de grenswaarde  $x$  (cm): zo lang mag een jongen hoogstens zijn om tot de 10% kortste te horen.

b  $(X \leq x | \mu = 182; \sigma = 10) = 0,1$



c

x links



$(X \leq x | \mu = 100; \sigma = 10) = 0,26$

$x \approx 93,6$

d y

$(X \leq y | \mu = 100; \sigma = 10) = \dots$

e ...

f

50



# 4.4 De vier typen

47

68 12 25

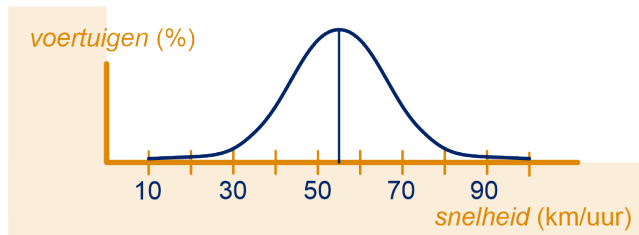
48

## Verkeersintensiteit en rijnsnelheden

$I$

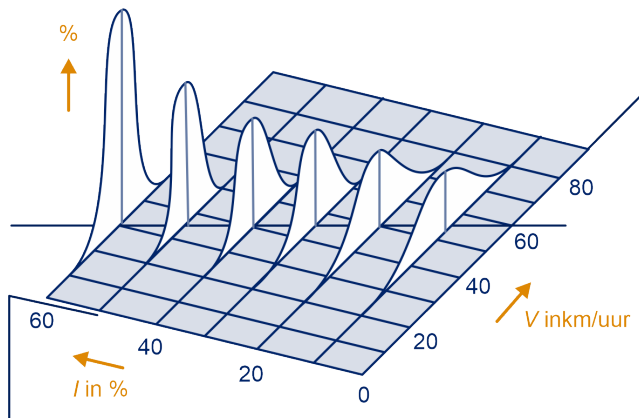
0

$I = 5$



56 70 13

a



$I$

$V$

$I$

# 4.4 De vier typen

49

## De vulmachine

Op welk gemiddelde gewicht moet de machine worden afgesteld opdat aan de EU-richtlijn wordt voldaan dat slechts 2% van de pakken een gewicht heeft onder de 985 gram ( $\sigma = 10$  gram)?

$$(X \leq 985 | \mu = ?; \sigma = 10) = 0,02$$

...;  $\sigma = 10$ ) = 0,02

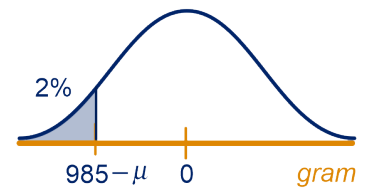
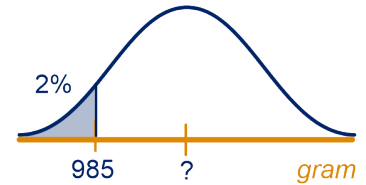
a

$$= 10$$

2

b

c



0



## Opmerking

$$(X \leq 985 | \mu = x; \sigma = 10) = 0,02$$



50

$$= 12$$

54

10

51

62

28

54

a

S

$$\underline{S - 62}$$

# 4.4 De vier typen

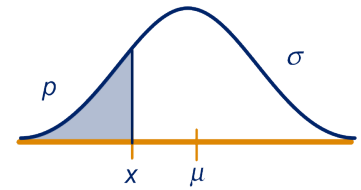
b  $(X \leq x | \mu = 0; \sigma = 1) = 0,28$

b  $\frac{54 - 62}{\sigma}$

c

### Opmerking

$(X \leq 54 | \mu = 62; \sigma = x) = 0,28$



$p = P(X \leq x)$



52

- a  $x = 17, \mu = 20, \sigma = 2, p = \dots$
- b  $x = \dots, \mu = 20, \sigma = 2, p = 0,1$
- c  $x = 17, \mu = \dots, \sigma = 2, p = 0,1$
- d  $x = 17, \mu = 20, \sigma = \dots, p = 0,1$

53

### $\mu$ en $\sigma$ zijn bekend

a  $\mu = 5, \sigma = 5, p = 0,96 \Rightarrow x = 110$

### $\mu$ en percentage zijn bekend

b  $\mu = 80, \sigma = 20, p = 0,77 \Rightarrow x = 105$

b

### $\sigma$ en percentage zijn bekend

c  $\mu = 105, \sigma = 4, p = 0,08 \Rightarrow x = 1000$



# 4.4 De vier typen

c

170,0

18 65

91,0



a = 160,4

= 7,2

18 65

170,0  
V

V

MED

V

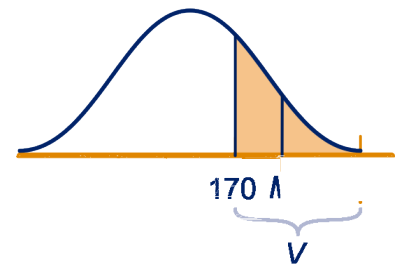
MED  
= 7,2

b  
c

MED = 172,6

= 160,4

91



18

65

113

1000

172,6

= 7,2

d

= 164,0

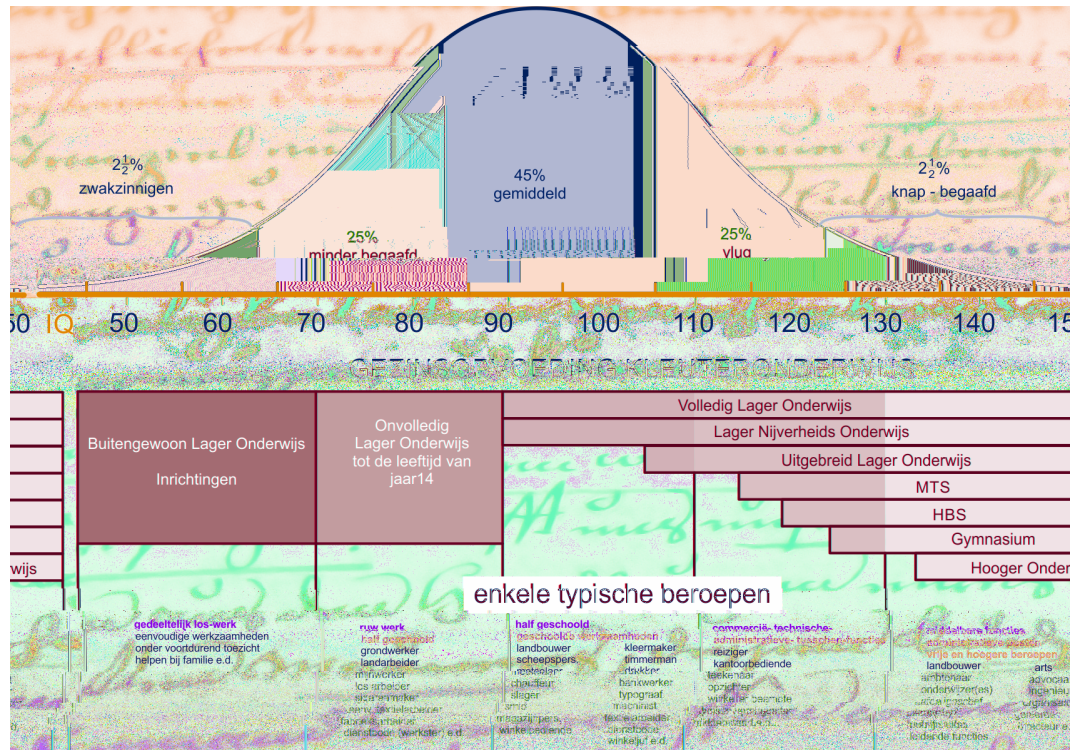
= 7,2

# 4.4 De vier typen

e

55

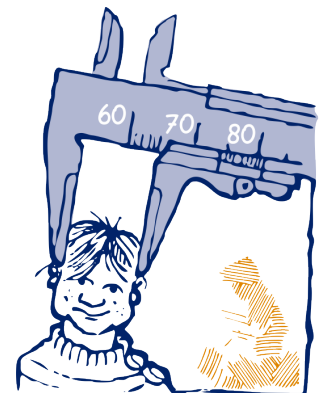
## Nogmaals IQ



$$100 - 27\frac{1}{2}$$

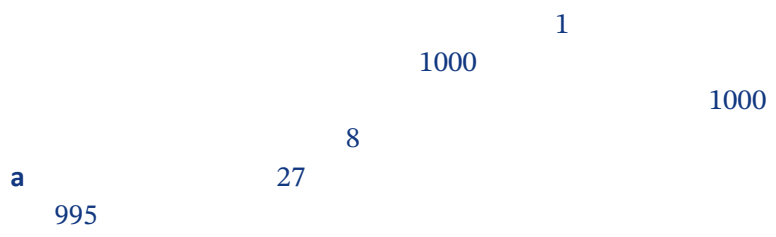
$$90 = 16,7$$

- a
- b
- c



# 4.4 De vier typen

56



Nominale hoeveelheid Q van een	toegelaten fout in minus
van 3	tot 100
van 30	tot 100
van 100	tot 100
van 200	tot 100
van 300	tot 100
van 300	tot 100
van 1000	tot 100



## 4.4 De vier typen

c

d

1

57

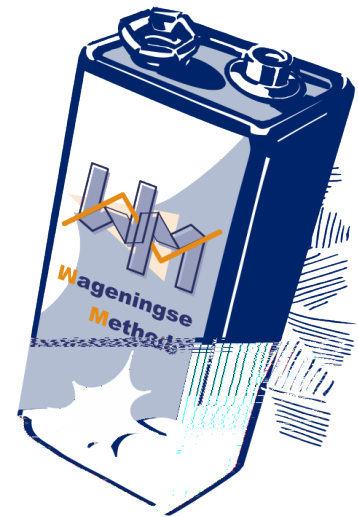
Batterijen

50

7

$8\frac{1}{2}$

a



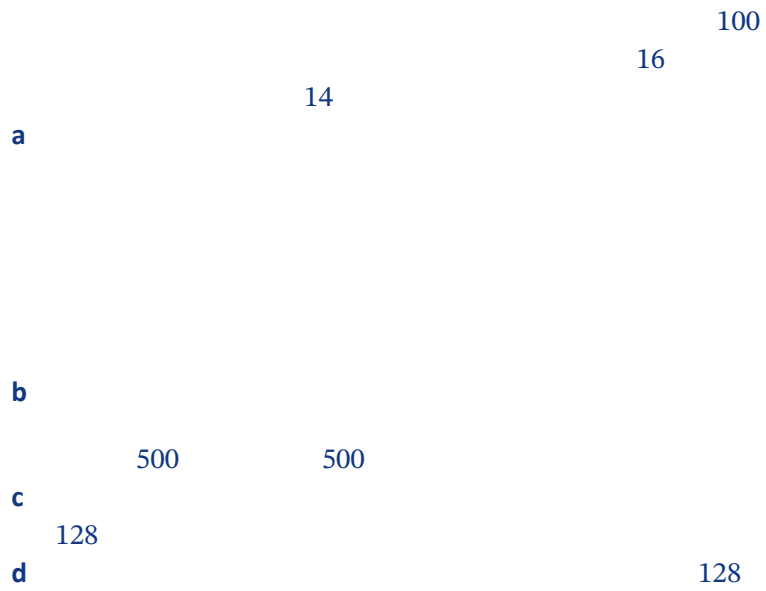
b

58

*Analysing data from the international PISA student evaluation study, Machin and Pekkarinen found higher variance in boys' than girls' results on mathematics and reading tests in most OECD countries.... en A study by Rosalind Arden and Robert Plomin from 2006 found greater variance among boys than among girls.*

100

## 4.4 De vier typen





# 4.5 Hoeveel mogelijkheden

59

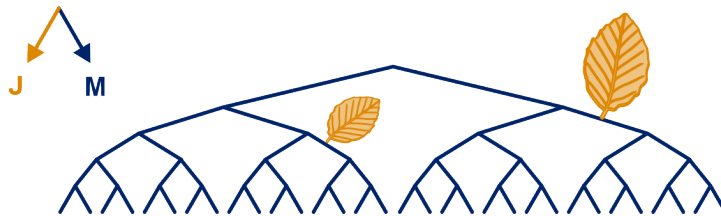


Vijf kinderen



a

b



c

d

e

f

	0	1	2	3	4	5

g

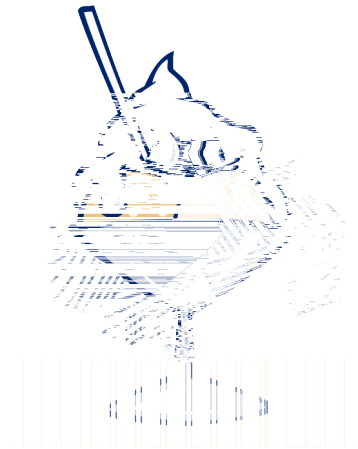
# 4.5 Hoeveel mogelijkheden

60

Twee bolletjes ijs

a

b



61

Letterrijtjes

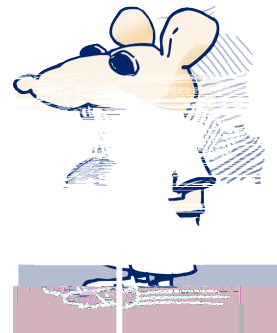


62

10

63

Braille



j	a	b	c	d	e	f	g	h	i
t	k	l	m	n	o	p	q	r	s
é	u	v	w	x	y-ij	z	ç	è	à
ï	ü	œ	ù	â	ê	î	ô	û	ë
”	*	”	,	;	:	.	?	!	()
ken	hoofdletter- teken	apostrof of afkortingsteken		koppel- of afbrekingsteken		cijfertel			
8	9	0	1	2	3	4	5	6	7
>	<	√	a	b	+	-	x	/	=

a

# 4.5 Hoeveel mogelijkheden



b

63

c

15

d

e

f

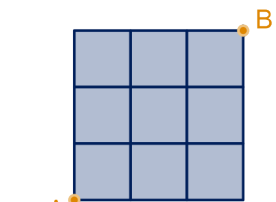
**Uit de encyclopedie**  
 Het brailleschrift bestaat uit groepen van zes punten waarmee 63 verschillende combinaties kunnen worden gevormd. Iedere groep van zes punten stelt een teken (letter, cijfer, enz) voor. De punten waaruit een teken is samengesteld, worden in reliëf in speciaal, enigszins stijf papier gedrukt, zodat ze door blinden kunnen worden afgetast. Een blinde die in het lezen van brailleschrift een zekere vaardigheid heeft verkregen, kan de leessnelheid van een normaal ziende evenaren.

64

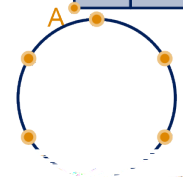
a



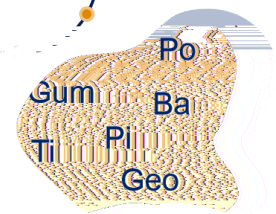
b



c



d



4 3

4

3

4

3

$$\binom{7}{3}$$

combinatiegetal

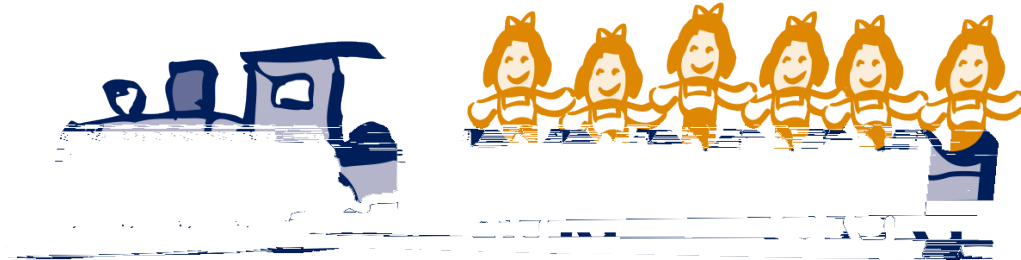
$n r$



## 4.5 Hoeveel mogelijkheden

65

### Overzichtsopgave



a

b

c

d

e

f

### Commentaar bij opgave opgave 65

a

b

c

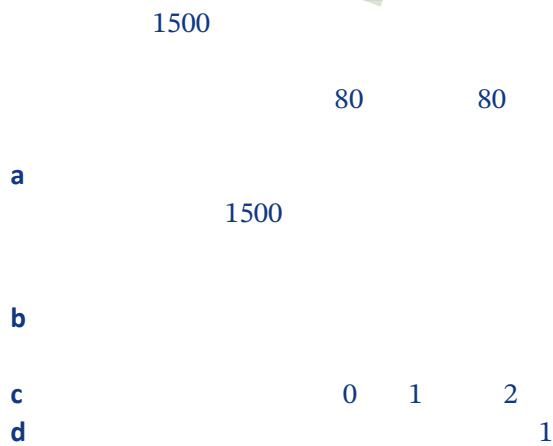
d

e

f

# 4.6 Binomiale kansexperimenten

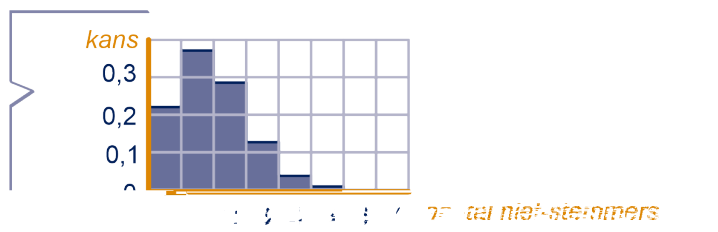
66



67

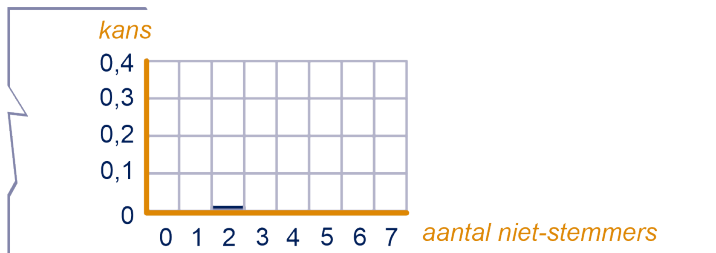
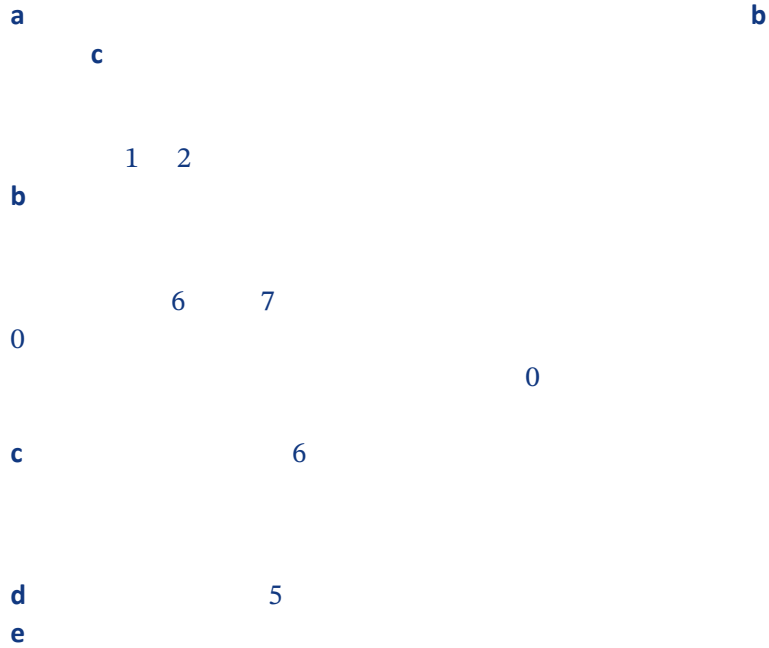
- a
- b
- c

68



# 4.6 Binomiale kansexperimenten

0 1 2 3 4 5 6 7  
kanshistogram



0,8

69





# 4.6 Binomiale kansexperimenten

$$\binom{18}{6}$$

6

12

$S$

6

$$P(S = 6 | p = \frac{2}{7}; n = 18)$$

71

$S$

a

3

$S$

b

6

$\frac{1}{2}$

72

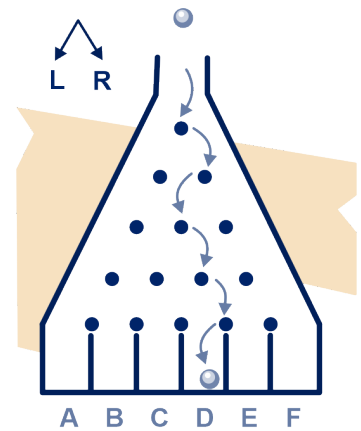
a

0,7

b

c

b



73

0,3  $S$

$k$	0	1	2	3	4	5
$(S = k)$	0,1681	0,3602				

a

b

c



## 4.6 Binomiale kansexperimenten

74

$$(S = \dots) = \binom{\dots}{\dots} \cdot (\dots)^{\dots} \cdot (\dots)^{\dots}$$

a

b

c

$k$   $n$

75

a b



Opmerking

parame-

ters

kansparameter  $p$

a  $n = 5$   $n$  **b**  $n = 12$   
 $p = 0,45$

76

a

b

77

a

b

c

1 2

d

## 4.6 Binomiale kansexperimenten

78

62

65

62

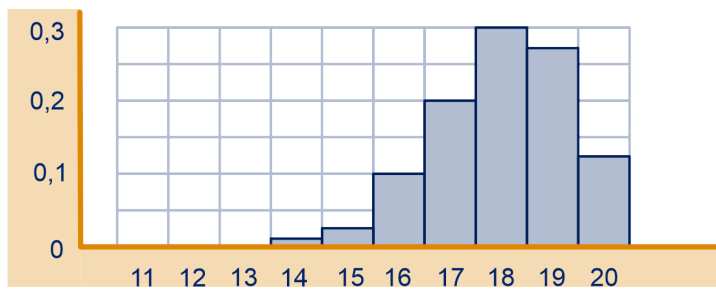
a

1 1000

b

S

79



a

$$(S = 17) = 0,1901$$

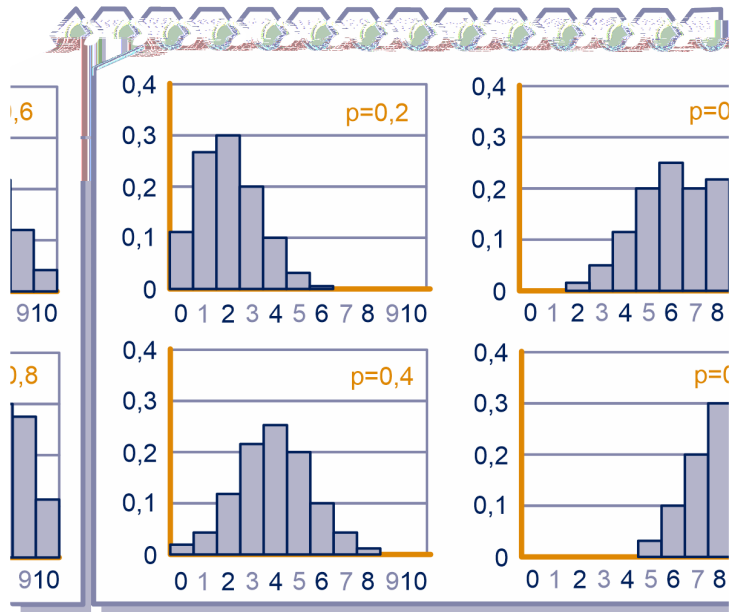
b

c

$$(S \geq 18)$$

# 4.6 Binomiale kansexperimenten

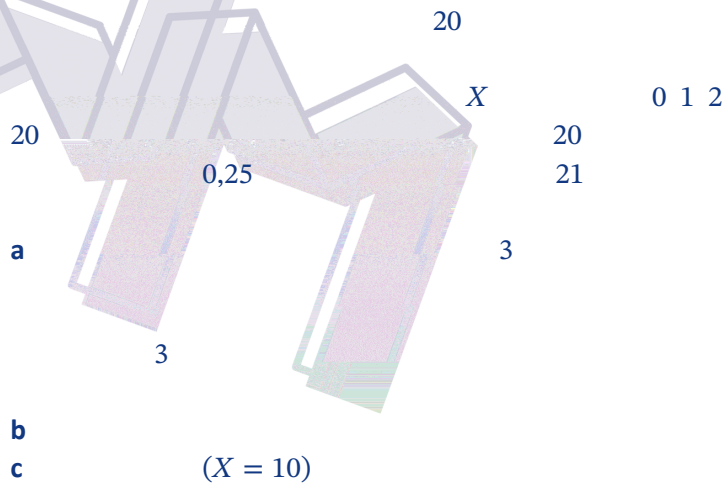
80



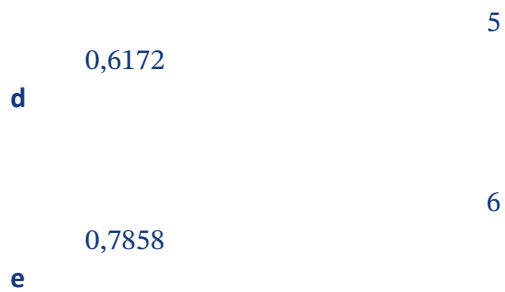
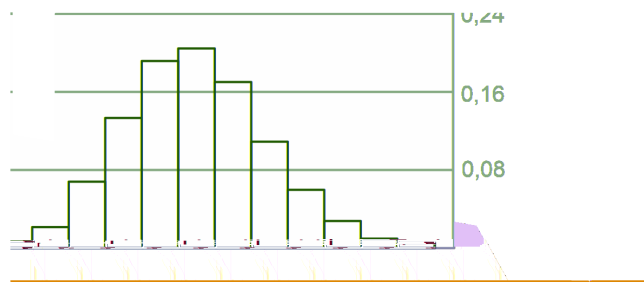
- a
- b
- c

# 4.7 Cumulatieve binomiale kansen

81



$k$	$P(x=k)$	$k$	$P(x \leq k)$
0	0,0032	0	0,0032
1	0,0211	1	0,0243
2	0,0670	2	0,0913
3	0,1339	3	0,2252
4	0,1896	4	0,4148
5	0,2024	5	0,6172
6	0,1686	6	0,7858
7	0,1124	7	0,8982
8	0,0609	8	0,9591
9	0,0270	9	0,9861
10	0,0100	10	0,9961
11	0,0030	11	0,9991
12	0,0007	12	0,9998
13	0,0002	13	1,0000
14	0,0000	14	1,0000
15	0,0000	15	1,0000
16	0,0000	16	1,0000
17	0,0000	17	1,0000
18	0,0000	18	1,0000
19	0,0000	19	1,0000
20	0,0000	20	1,0000



82



## 4.7 Cumulatieve binomiale kansen

83

0  
cumulatieve

6

0,4  $X$

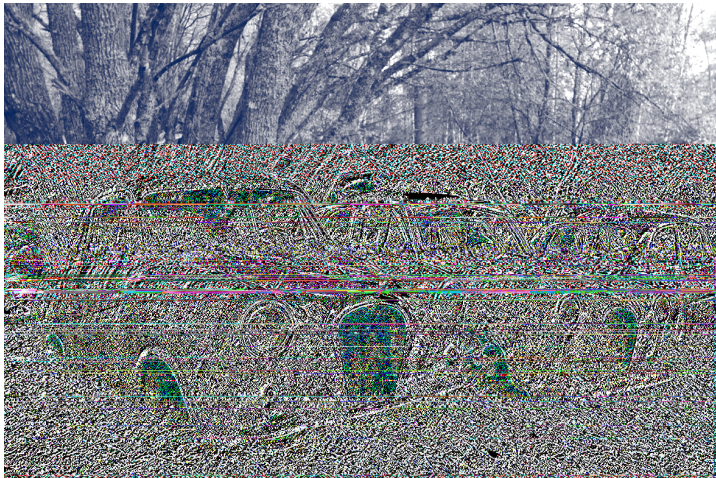
## 4.7 Cumulatieve binomiale kansen

85

*tien keer werpen met een dobbelsteen*

- a  $n$   
*succes*  
 $p$
- $X$   
b (...  
c

86



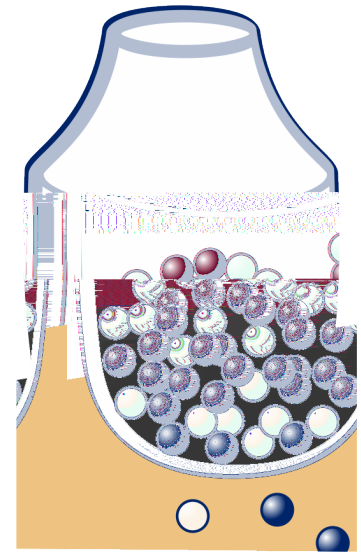
- a 100  
1 100
- b 100



**Opmerking**

# 4.7 Cumulatieve binomiale kansen

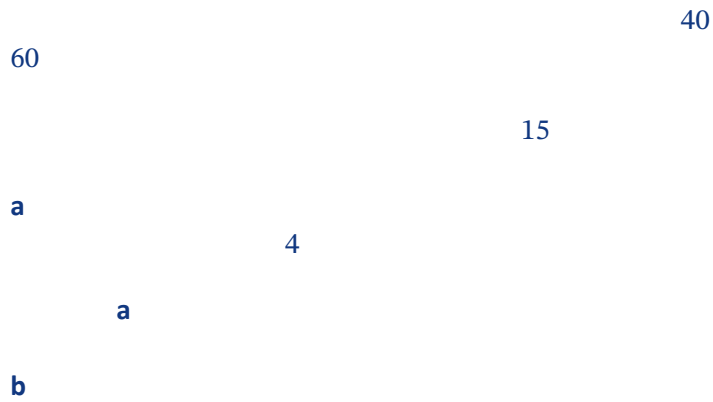
87



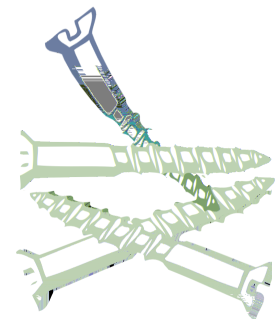
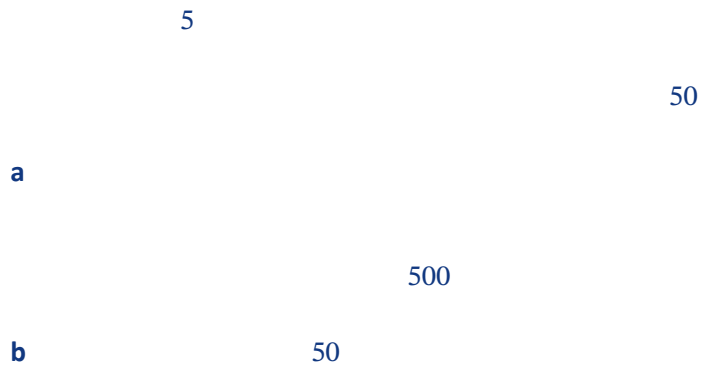
88



89



90



## 4.7 Cumulatieve binomiale kansen

91



a

4

1

b

4

4

92

5

50

10

25

a

312

b

1000

93

70

18

80

94

90

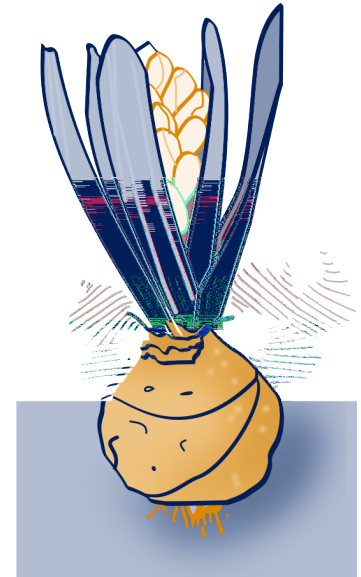
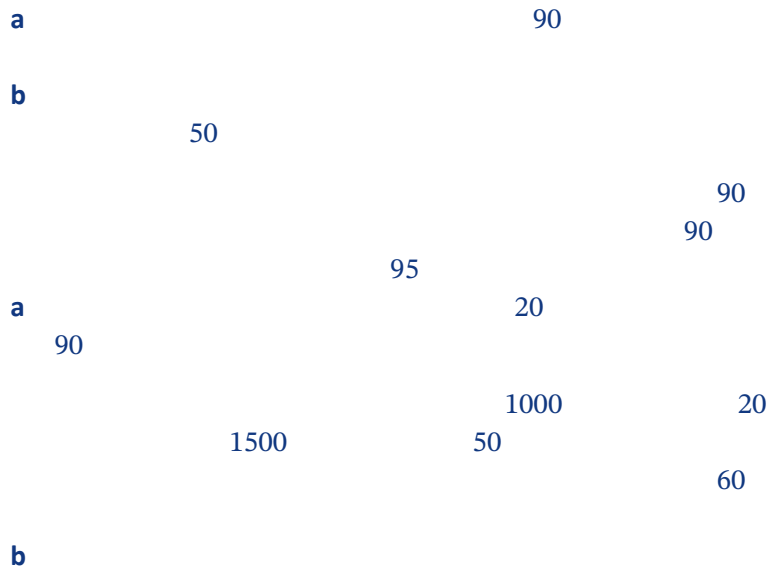
90

20

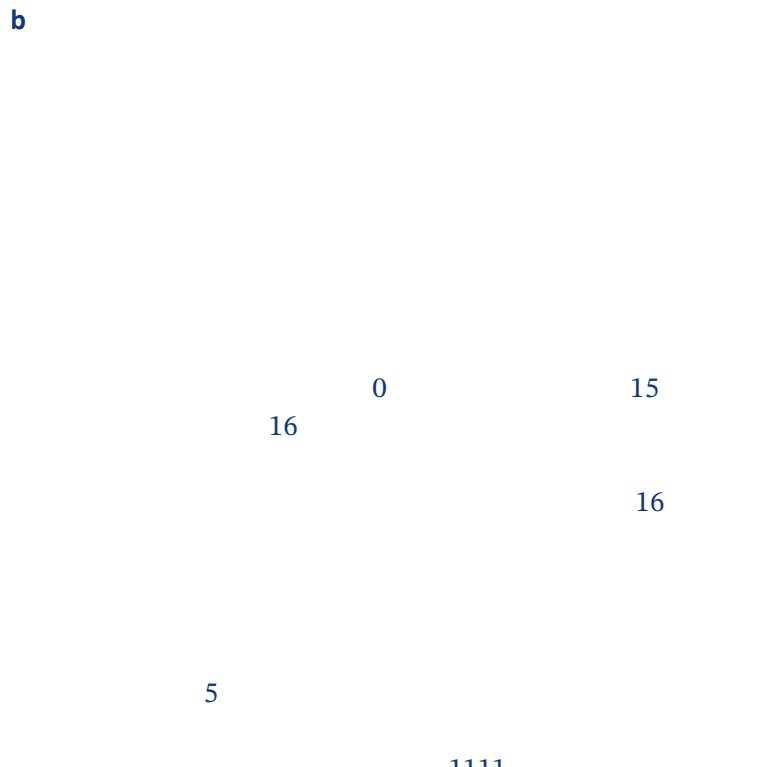


# 4.7 Cumulatieve binomiale kansen

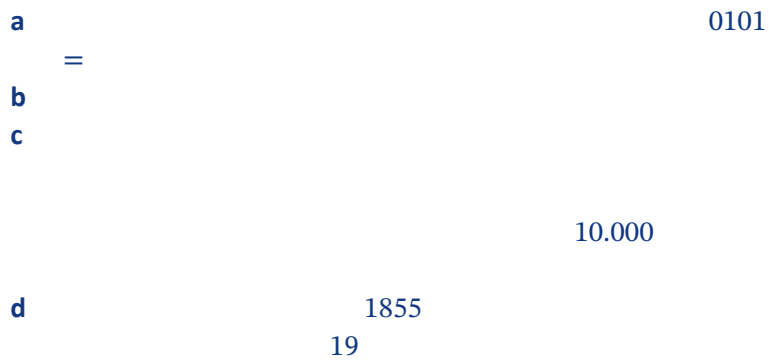
95



96



0	0	0	0	= wit	
0	0	0	1	↓	
0	0	1	0		
0	0	1	1		
0	1	0	0		
0	1	0	1		
0	1	1	0		
0	1	1	1		
1	0	0	0		
1	0	0	1		
1	0	1	0		
1	0	1	1		
1	1	0	0		
1	1	0	1		
1	1	1	0		
1	1	1	1		= zwart



## 4.7 Cumulatieve binomiale kansen

97

```
000111000111      0101
  100101000110
0 000  0 101  1 000  0 110  1
          0101
```

a

0,9928

b

4

12

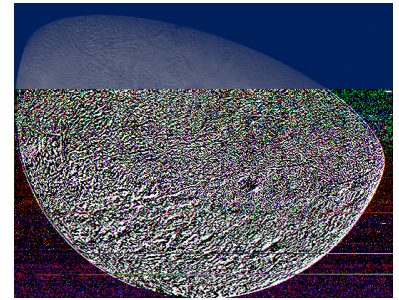
c

d

e

4

f



## 4.8 Met en zonder terugleggen

98

a

b

1000

200



99

100

101

a

b

c



102

a

b

c



## 4.8 Met en zonder terugleggen

b

c

b

104

105

854

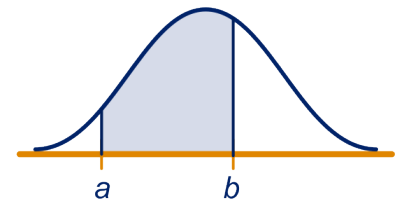
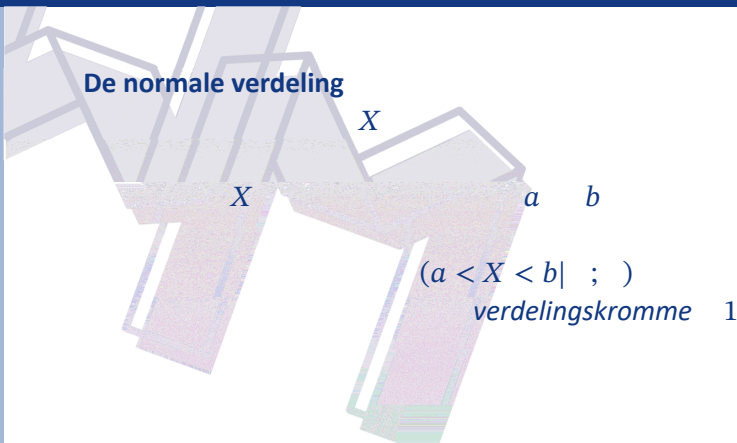
10

17

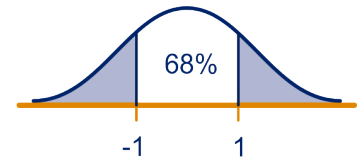
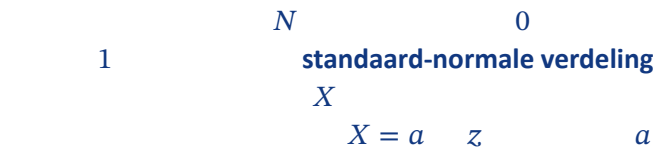


# 4.9 Eindpunt

## De normale verdeling



## De standaard-normale verdeling



$$z = \frac{a - \mu}{\sigma}$$

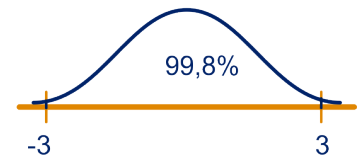
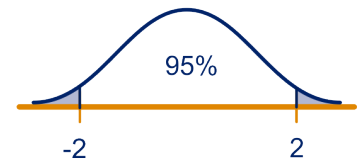
## standaardiseren

$$z = \frac{a - \mu}{\sigma} = \frac{-1 - 0}{1} = -1 \quad 68$$

$$z = \frac{a - \mu}{\sigma} = \frac{2 - 0}{1} = 2 \quad 0$$

$$z = \frac{a - \mu}{\sigma} = \frac{5 - 0}{3} = 1,67 \quad 0$$

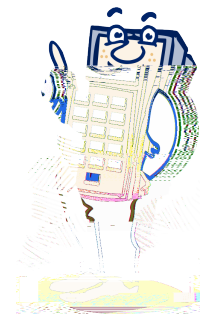
$$z = \frac{a - \mu}{\sigma} = \frac{0,2 - 0}{1} = 0,2$$



## De normale verdeling op de GR

$$(a < X < b | ; ) \quad (X > a | ; )$$

$$(X < a | ; ) = p$$



## Zonder en met terugleggen

$$(3 \text{ zonder } 2) = \frac{\binom{10}{3} \cdot \binom{15}{2}}{\binom{25}{5}} = \frac{60}{253} \approx 0,2372$$

$$(3 \text{ met } 2) = \binom{5}{2} \cdot \left(\frac{10}{25}\right)^3 \cdot \left(\frac{15}{25}\right)^2 \approx 0,2304$$

## 4.9 Eindpunt

nomiaal verdeeld  $X$  binomiale kans  $X$  bi-

met

**Cumulatieve binomiale kans**

$$\begin{array}{l} X \quad \quad \quad 0 \ 1 \ 2 \ 3 \ 4 \ \dots \\ (X \leq 3) \quad \text{cumulatieve kans} \\ (X \leq 3) = (X = 0) + (X = 1) + (X = 2) + (X = 3) \end{array}$$

**Op de GR**

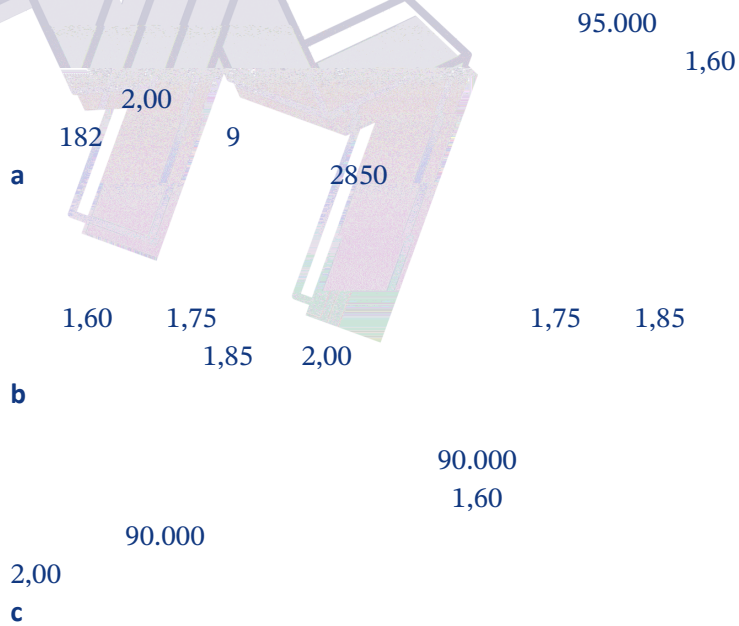
$$(X = k | n; p) \quad (X \leq k | n; p)$$



# 4.10 Extra opgaven

1

## Normale verdeling



2

## Sollicitatiegesprek

$$= \frac{115}{15} = 13$$

3

## Pakken groente

$$\frac{150}{5} = 90 \quad \frac{90}{150}$$

4

## Frisdrank

$$\frac{1}{1,03} = 2,8$$



## 4.10 Extra opgaven

5

Appels

15

80

6

Kraanleertjes

3,6 4,4

= 0,2

15 100

= 4

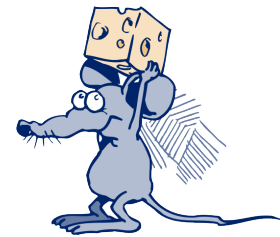
= 0,3

13 100

= 4

7

Caloriearm dieet



33

2,7

a

36

45

0,1

51,5

b

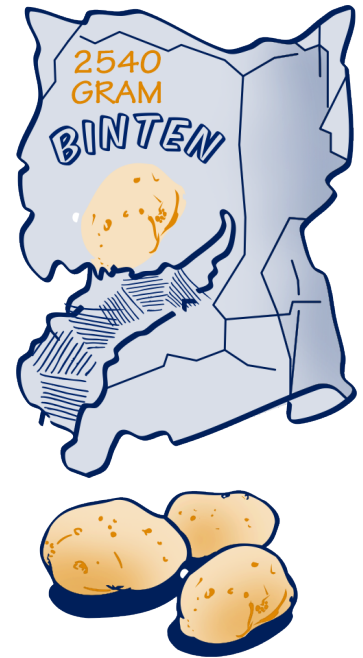
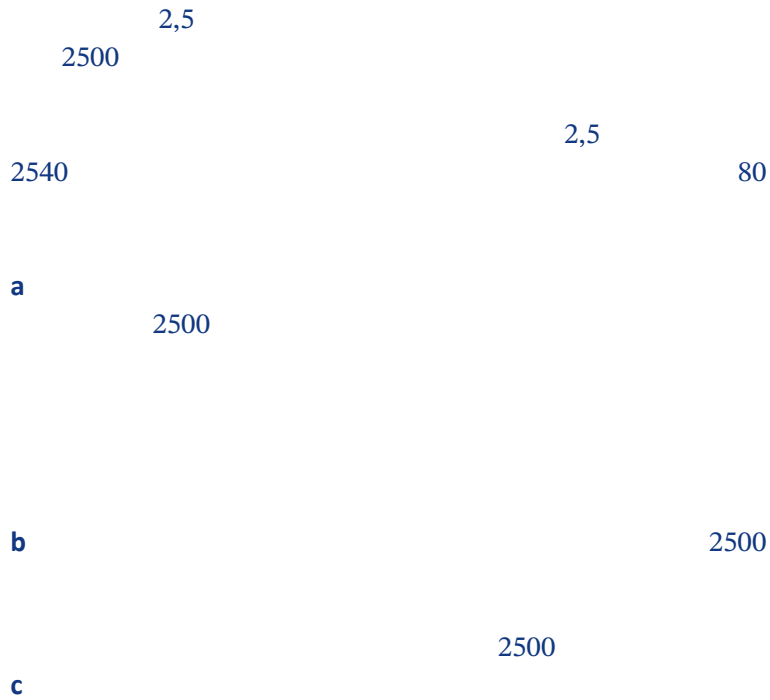
2,1

c

## 4.10 Extra opgaven

8

Zakken aardappelen



9

Omzet



# 4.10 Extra opgaven

## Binomiale verdeling en meer

10

### ASCII-codes



32	00100000	SPATIE	65	01000001	A	97	01100001	a
33	00100001	!	66	01000010	B	98	01100010	b
34	00100010	"	67	01000011	C	99	01100011	c
35	00100011	#	68	01000100	D	100	01100100	d
36	00100100	\$	69	01000101	E	101	01100101	e
37	00100101	%	70	01000110	F	102	01100110	f
38	00100110	&	71	01000111	G	103	01100111	g
39	00100111	'	72	01001000	H	104	01101000	h
40	00101000	(	73	01001001	I	105	01101001	i
41	00101001	)	74	01001010	J	106	01101010	j
42	00101010	*	75	01001011	K	107	01101011	k
43	00101011	+	76	01001100	L	108	01101100	l
44	00101100	,	77	01001101	M	109	01101101	m
45	00101101	-	78	01001110	N	110	01101110	n
46	00101110	.	79	01001111	O	111	01101111	o
47	00101111	/	80	01010000	P	112	01110000	p
48	00110000	0	81	01010001	Q	113	01110001	q
49	00110001	1	82	01010010	R	114	01110010	r
50	00110010	2	83	01010011	S	115	01110011	s
51	00110011	3	84	01010100	T	116	01110100	t
52	00110100	4	85	01010101	U	117	01110101	u
53	00110101	5	86	01010110	V	118	01110110	v
54	00110110	6	87	01010111	W	119	01110111	w
55	00110111	7	88	01011000	X	120	01111000	x
56	00111000	8	89	01011001	Y	121	01111001	y
57	00111001	9	90	01011010	Z	122	01111010	z
58	00111010	:	91	01011011	[	123	01111011	[
59	00111011	;	92	01011100	\	124	01111100	\
60	00111100	<	93	01011101	]	125	01111101	]
61	00111101	=	94	01011110	^	126	01111110	^
62	00111110	>	95	01011111	_	127	01111111	_
63	00111111	?	96	01100000	`			
64	01000000	@						

Codes van schakelingen volgens het ASCII systeem. De volgnummers 0 t/m 31 (tweecilijg 00000000 t/m 00011111) zijn gereserveerd voor signalen die niet afdrukbaar zijn (bijvoorbeeld / = belijnguss).

De waarden vanaf 128 (tweecilijg 10000000), die zijn dus alle waarden die tweecilijg met een 1 beginnen, worden verschillend per computer en per toepassing voor van alles en nog wat gebruikt.

a

b

## 4.10 Extra opgaven

c

d

11

$$\begin{array}{r} 90 \\ 2 \\ \hline 180 \\ 65 \\ \hline 2 \cdot 65 - 90 = 40 \\ 40 \end{array}$$

a

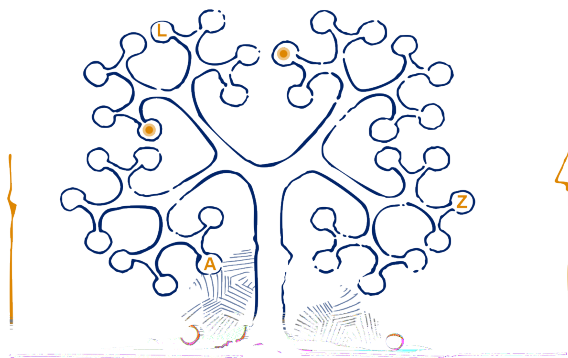
b

c

d

12

Een binaire boom.



a

# 4.10 Extra opgaven

13

b

c

d



a

b

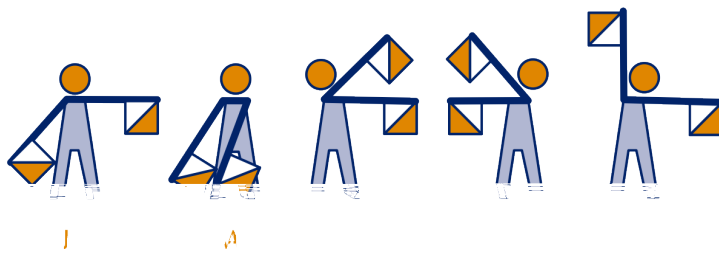


14

$$\binom{13}{4} \cdot 0,8^9 \cdot 0,2^4$$

15

De semafoor



a

b

c

# 4.10 Extra opgaven

16

## Schotpercentage



70  
 a 20  
 b 70  
 55 75  
 $55 \leq \quad \leq 75$

17

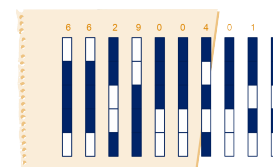
a  
 b  $\binom{8}{3} \cdot \binom{4}{0} + \binom{8}{2} \cdot \binom{4}{1} + \binom{8}{1} \cdot \binom{4}{2} + \binom{8}{0} \cdot \binom{4}{3}$   
 c a b  
 d

18

10  
 50

19

## Een streepjescode



# 4.10 Extra opgaven

20

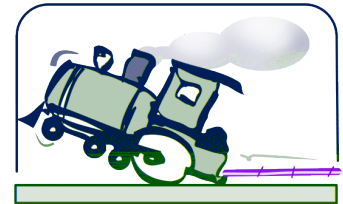
- a
- b
- c



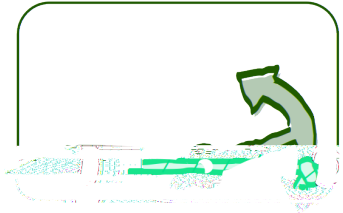
21

- a
- b
- c

0,2  
0,05



0,2



0,24

	0	1	2	3	4

- d
- e

40

# 4.10 Extra opgaven

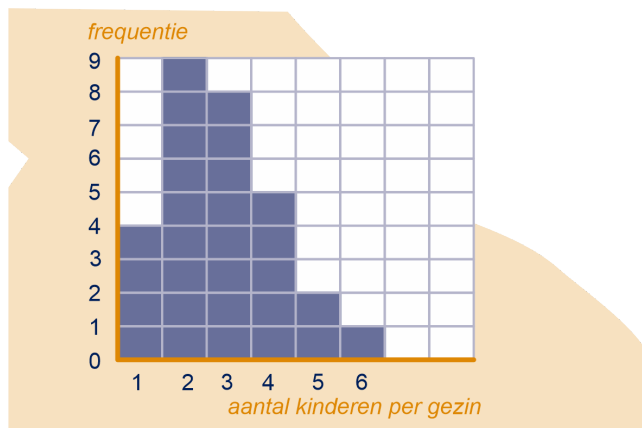
22

Bridge

	13	13	13	52	13
a					
b			3		4
c					
d					
e					



23



a



## 4.10 Extra opgaven

24

b 100  
c 95

a  
b 10

1 11  
c

d 25 250

25

4 100 36  
32

a  
b  
c



# 4.10 Extra opgaven

26

10

50

a

b

10 50 0

c

d




e

27

20

a

b



28

Een loterij

1

1000 2

100 3

25

1000

a

b

1000

c

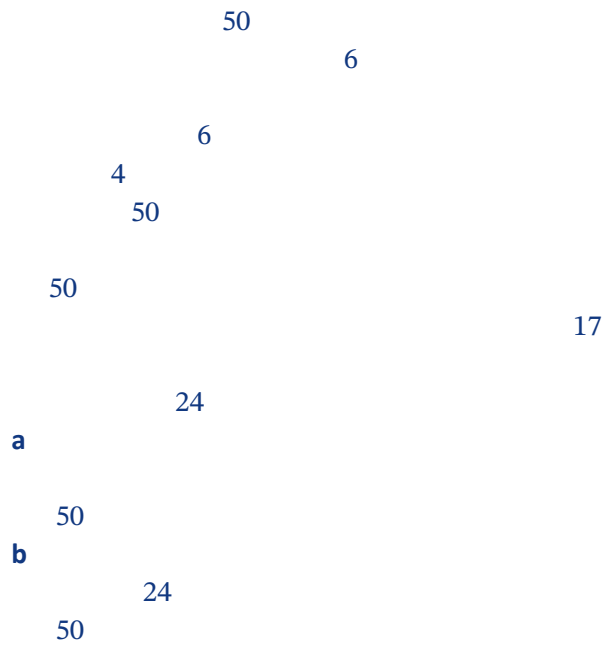
29

De kans op dubbel-zes in 24 worpen

50

24

## 4.10 Extra opgaven





# 4 Kansen\_2

## Normaal of niet

1

a 6  
b 4

2

a 10°  
b 13°

3

a 90  
b

4

5

a  
b  
c

6

7

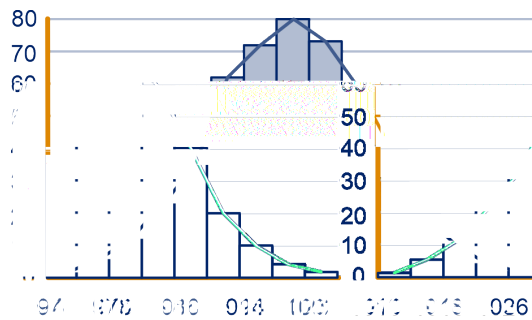
a  
b  
c

8

a  
b

9

a



b

c  $\frac{1}{500}(1 \cdot 972 + 6 \cdot 976 + \dots + 11 \cdot 1020 + 5 \cdot 1024 + 2 \cdot 1028) = 1000$

d 51

e 69

10

a  
b



# 4 Kansen\_2

b  $(X > 42 | = 40; = 8) \quad 40,1$   
 c  $(30 < X < 50 | = 40; = 8) \quad 78,9$

17

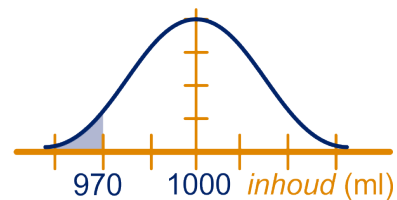
$(X > 1100 | = 1200; = 200) = 0,6915... \quad (X > 1100 | = 1250; = 250) = 0,7257... \quad B$

18

a  
 b  $2 \cdot (X < 7485 | = 7500; = 6) \approx 0,0124 \quad 1,24$   
 c  $x \quad (1 - 0,0124)x = 25 \quad x = \frac{25}{1 - 0,0124} \approx 25,31$

19

a  
 b 2,5  
 $(X < 970 | = 1000; = 15) \quad 2,3$   
 c  $\frac{2}{= 2000 \quad = 30}$   
 $(X < 1980 | = 2000; = 30) \quad 25,2$



20

a  $\approx 15$   
 b  $(115 < X | = 100; = 15) \quad 16$   
 c  $(119 < X < 123 | = 100; = 15) \quad 4,2$

21

a  $(X < 70 | = 90; = 15) \approx 0,0912 \quad (70 < X < 100 | = 90; = 15) \approx 0,6563$   
 $(X > 100 | = 90; = 15) \approx 0,2525 \quad 9,1 \quad 65,6$   
 25,3  
 b  $600 \cdot (0,0912 \cdot 20 + 0,6563 \cdot 25 + 0,2525 \cdot 30) = 15.483,84$

22

a  $(X < 985 | = 1000; = 10) = 0,0667$   
 b 1006

## Het bord van Galton

23

a  
 b  $\quad \quad \quad 3 \quad \quad 7$   
 c  
 d  $\quad \quad 1 \quad \quad \quad 252$

24

25

26

a  $\mu = -0,065$   
 b  $\quad \quad \quad 64 \quad \quad \quad 1$

# 4 Kansen\_2

27

a 125 375 375 125

$$62\frac{1}{2} \quad 250 \quad 375 \quad 250 \quad 62\frac{1}{2}$$

b  $1024 = 2^{10}$

c 1 10 45 120 210 120 45 10 1

28

a  $\binom{10}{4} = 210$   $\frac{210}{1024}$

b  $\frac{120+210+252+210+120}{1024} = \frac{912}{1024}$

29

a  
b

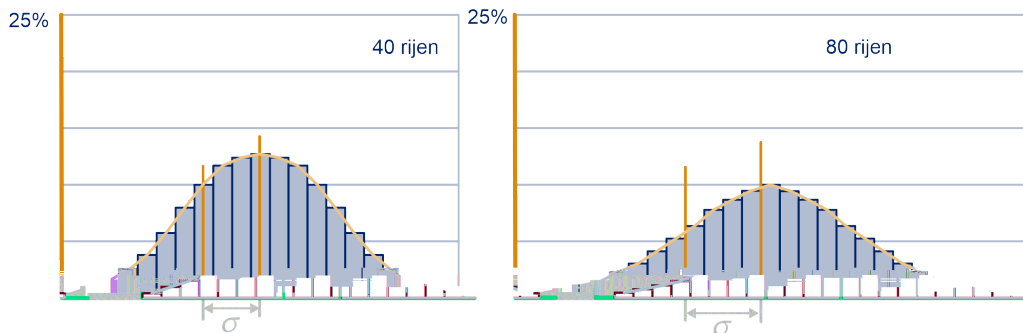
30

$$\frac{28}{256}$$

31

a  $\frac{1}{2}\sqrt{40} \approx 3,1623$   $\frac{1}{2}\sqrt{80} \approx 4,4721$

b



c

32

a  $\frac{1}{2}\sqrt{16} = 2$   $\frac{1}{2}\sqrt{64} = 4$   
1

b  $\frac{1}{2}\sqrt{80} = \frac{1}{2}\sqrt{4\sqrt{20}} \approx 2 \cdot \frac{1}{2}\sqrt{20}$

c

33

a  
b

**de z-waarde**

34

35

a  
b

c  $\binom{10}{8} \cdot \left(\frac{1}{2}\right)^{10}$  5



# 4 Kansen\_2

36

a

b

c  $\frac{1}{4}$     $\frac{1}{8}$

d  $\frac{1}{4}$

37

a  $\frac{11 - 12,1}{0,8} \approx -1,38$     $\frac{13,5 - 12,1}{0,8} = 1,75$

b

c  $x \quad \frac{x - 12,1}{0,8} = -1,7 \Leftrightarrow x = 12,1 - 0,8 \cdot 1,7 = 10,74$

38

a  $z \quad 1,67 \quad 2,20$

b 164

c 148

39

40

a 
$$\begin{array}{r} X \\ X - 10 \\ \frac{X - 10}{2} \end{array} \quad \begin{array}{r} 10 \\ 0 \\ 0 \end{array} \quad \begin{array}{r} 2 \\ 2 \\ 1 \end{array} \quad \begin{array}{r} 10 \\ 0 \\ 0 \end{array}$$

b 
$$\begin{array}{r} X - 10 \\ \frac{X - 10}{2} \end{array} \quad \begin{array}{r} 10 \\ 2 \end{array}$$

c 0,6612...

d 0,6612...

e 0,6612...

41

0,3336 0,6664 0,7745 0,4474

42

-0,84 0,67 0,84 -0,39

43

a -0,52 0,52

b

44

a  $z \quad 60 \quad z \quad \frac{60 - 56}{8} = 0,5$

$z \quad \frac{45 - 42}{6} = 0,5$

b 31

45

0  
-0,43 0,43  
-0,67 0 0,67  
-0,84 -0,25 0,25 0,84

## De vier typen

46

a  $(X \geq 200 | = 182; = 10) = 0,0359 \quad 3,59$

## 4 Kansen\_2

b 169

c

d  $100 + (100 - 93,6) = 106,4$

e  $1 - 0,26 = 0,74$

f  $(X \leq x | \mu = 182; \sigma = 10) = 0,25 \quad x = 175,3 \quad (X \leq x | \mu = 182; \sigma = 10) = 0,75 \quad x = 188,7$

47

$(X \leq x | \mu = 68; \sigma = 12) (X \leq x | \mu = 68; \sigma = 12) \quad x = 59,91 \quad 60$

48

a  $(X \geq 70 | \mu = 56; \sigma = 13) = 0,1408 \quad 14$

b

a  $= 1005,5$

b  $x \quad (X \leq x | \mu = 0; \sigma = 10) = 0,02$

$x = -20,537$

c  $-20,537 = 985 - \quad = 20,537 + 985 \approx 1005,5$

50

$x \quad (X \leq x | \mu = 0; \sigma = 12) = 0,1$   
 $x \approx -15,38 \quad 54 + 15,38 = 69,38$

51

a 13,7

b -0,5828

c 13,7

52

a  $(X \leq 17 | \mu = 20; \sigma = 2) = 0,0668 \quad p = 0,0668$

b  $x \quad (X \leq x | \mu = 20; \sigma = 2) = 0,1$

$x = 17,4369$

c  $x \quad (X \leq x | \mu = 0; \sigma = 2) = 0,1$

$x = -2,5631 \quad 17 - \quad = -2,5631 \quad = 19,5631$

d  $x \quad (X \leq x | \mu = 0; \sigma = 1) = 0,1$

$x = -1,2816 \quad \frac{17 - 20}{1} = -1,2816 \quad = \frac{3}{1,2816} \approx 2,34$

53

a  $(X > 110 | \mu = 96; \sigma = 5) = 0,00255... \quad 0,3$

b

$\frac{77 - 80}{5} = -0,841... \quad a \quad (X < a | \mu = 0; \sigma = 1) = 0,2 \quad a \approx -0,841...$   
 $= \frac{77 - 80}{-0,841...} = 3,56...$

c

8 1000 0,8  $a \quad (X < a | \mu = 0; \sigma = 1)$   
 $1) (X < a | 0; 1) \quad a = 2,408... \quad z \quad 105 \quad \frac{105 - 1000}{4} = 2,408... \quad = 105 - 4 \cdot 2,408... \approx 95,4$

# 4 Kansen\_2

54

a  $(X < a | = 0; = 1) = 0,91$   $z$   $170,0$   $a$   
 $\frac{170,0 - 160,4}{1,342} = \frac{170,0 - 160,4}{1,342} = 7,15\dots$   $z$   $1,342$   $1,342 =$

b 50

c  $MED$   $91 + \frac{1}{2} \cdot 9 = 95,5$   $z$   
 $1,694$   $1,694 = \frac{MED - 160,4}{7,2}$   $MED = 160,4 + 1,694 \cdot 7,2 \approx$

1,726

d  $172,6$   $0,113$   $z$   $172,6$   
 $a$   $(X < a | = 0; = 1) = 1 - 0,113$   
 $z$   $1,21$

$1,21 = \frac{172,6 -}{7,2} = 172,6 - 7,2 \cdot 1,21 = 163,9$

e  $(X < 170,0 | = 164,0; = 7,2) = 0,7977$

55

a  $a$   $(X < a | = 0; = 1) = 0,275$   $a =$   
 $-0,60$   $z$   $90$   $-0,60$   $-0,60 = \frac{90 - 100}{0,60} = \frac{10}{0,60} = 16,7$

b  $(X > 115 | = 100; = 16,7) \approx 0,185$   $18,5$

c  $(120 < X < 124 | = 100; = 16,7) \approx 0,04$   $4$

56

a  $(X < 995 | = 1000; = 10) = 26,6\dots$

b  $22,5$   $9,9$

c

$0,02$   $z$   $985$   $-2,05$   $-2,05 = \frac{985,5 -}{5}$   $z$   $985$   $(X < a | = 0; = 1) =$

500

d

$-2,05 = \frac{241 -}{5} = 241 + 5 \times 2,05 \approx 251,25$

57

a  $8\frac{1}{2}$   $510$   $a$   
 $z$   $510$

$(X < a | = 0; = 1) = 0,07$

$-1,479 = \frac{510 -}{50} = 510 + 1,479 \cdot 50 = 584$

b *je trekt een lege batterij* *je trekt een nieuwe batterij*

$= \frac{2}{12} \cdot \frac{10}{11} \cdot \frac{9}{10} \cdot \frac{1}{9} + \frac{10}{12} \cdot \frac{2}{11} \cdot \frac{9}{10} \cdot \frac{1}{9} + \frac{10}{12} \cdot \frac{9}{11} \cdot \frac{2}{10} \cdot \frac{1}{9} = \frac{1}{22}$

# 4 Kansen\_2

58

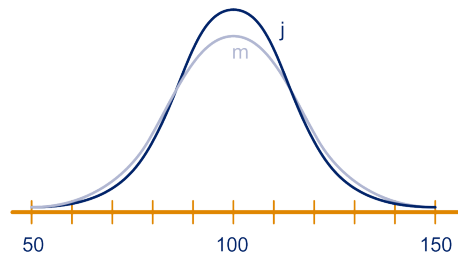
a  
b

120

c

$$\frac{128}{0,0400\dots} \left( X > 128 \mid \begin{matrix} = 100; \\ = 16 \end{matrix} \right) = \frac{100}{500} = 0,2$$

$$\frac{128}{20} \left( X > 128 \mid \begin{matrix} = 100; \\ = 14 \end{matrix} \right) = \frac{14}{31} = 0,0227\dots$$



$$\frac{500}{500} \left( X > 128 \mid \begin{matrix} = 100; \\ = 14 \end{matrix} \right) = 0,0227\dots$$

d

## Hoeveel mogelijkheden

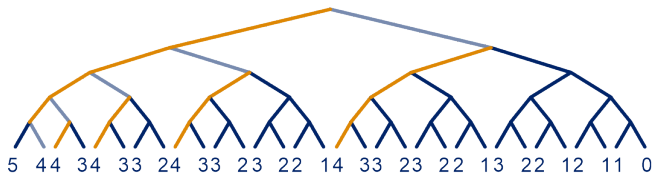
59

a  $\left(\frac{1}{2}\right)^5 = \frac{1}{32}$

b 5

c 32

d



e

f

	0	1	2	3	4	5
	$\frac{1}{32}$	$\frac{5}{32}$	$\frac{10}{32}$	$\frac{10}{32}$	$\frac{5}{32}$	$\frac{1}{32}$

g

1

60

a  $7 \cdot 6 : 2 = 21$

b  $21 + 7 = 28$

61

$$3^{10} = 59049$$

$$10^3 = 1000$$

62

9

4

6 12

5

6

$$6^3 = 216$$

$$\frac{27}{216} = \frac{1}{8}$$

63

a

b 25975

## 4 Kansen\_2

c  $2^6 = 64$

63

d

e  $6 \cdot 15 \cdot 6 \cdot 1$

f  $64 - (1 + 6 + 15 + 15 + 6 + 1) = 20$

64

a  $\binom{6}{3} = 20$

b  $\binom{6}{3} = 20$

c  $\binom{6}{3} = 20$

d  $\binom{6}{3} = 20$

65

a  $6! = 720$

b  $2^6 = 64$

c  $6 \cdot 5 = 30$

d  $\binom{6}{2} = 15$

e  $\binom{6}{3} = 15$

f 22

### Binomiale kansexperimenten

66

a 300

b  $0,2 \cdot 0,2 \cdot 0,2 = 0,008$

c 0,512 0,384 0,096

d  $0,512 + 0,384 + 0,096 + 0,008 = 1$

67

a  $0,8 \cdot 0,8 \cdot 0,2 \cdot 0,2 \cdot 0,8 \cdot 0,8 \cdot 0,2 = 0,0033$   $0,0033 \binom{7}{3} = 35$

b  $\binom{7}{3} \cdot 0,0033 = 0,115$

c  $0,2^2 \cdot 0,8^5$

$$\binom{7}{2}$$

$$\binom{7}{2} 0,2^2 \cdot 0,8^5$$

68

a

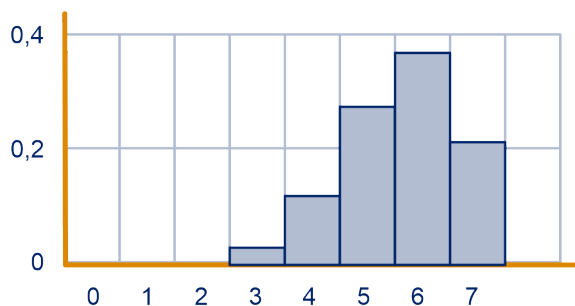
b  $\cdot 0,2 = 1,4$

c  $\binom{7}{6} 0,2^6 \cdot 0,8 = 0,0003584$

d  $\binom{7}{5} \cdot 0,2^2 \cdot 0,8^5 = 0,275$

# 4 Kansen\_2

e



69

a

$$\frac{1}{6} \frac{5}{6} 10$$

b

$$\frac{1}{2} \frac{1}{2} 15$$

c

$$\frac{1}{3} \frac{2}{3} 7$$

d

$$\frac{1}{4} \frac{3}{4} 20$$

e

$$\frac{18}{37} \frac{19}{37} 20$$

f

$$0,9 \ 0,1 \ 10$$

70

71

a  $P(S = 3 | p = \frac{1}{4}; n = 10) = \binom{10}{3} \cdot (\frac{1}{4})^3 \cdot (\frac{3}{4})^7 \approx 0,25$

b  $P(S = 6 | p = \frac{1}{2}; n = 9) = \binom{9}{6} \cdot (\frac{1}{2})^9 \approx 0,164$

72

a  $\frac{5}{16}$

b  $\binom{5}{4} \cdot 0,7^4 \cdot 0,3^1 = 0,36015$

c

$$5 \cdot 0,7 = 3,5$$

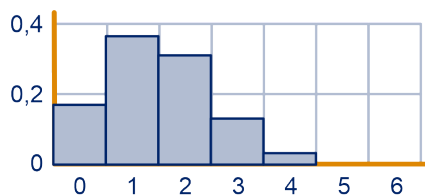
73

a  $0,7^5 \approx 0,1681 \quad 5 \cdot 0,7^4 \cdot 0,3 \approx 0,3602$

b

$k$	2	3	4	5
$P(S = k)$	0,3087	0,1323	0,0284	0,0024

c



74

a  $(S = 3) = \binom{5}{3} \cdot 0,45^3 \cdot 0,55^2$

## 4 Kansen\_2

b  $(S = 3) = \binom{12}{3} \cdot 0,45^3 \cdot 0,55^9$

c  $(S = k) = \binom{n}{k} \cdot 0,45^k \cdot 0,55^{n-k}$

75

0,2757 0,0923

76

a  $\frac{1}{2048}$   $\frac{1}{2}$   $\left(\frac{1}{2}\right)^{11} =$

b  $\binom{11}{5} \cdot \left(\frac{1}{2}\right)^{11} \approx 0,226$

77

a  $(S = 2 | p = \frac{2}{3}; n = 3) = 0,444$

b  $\frac{\binom{10}{2} \cdot \binom{5}{1}}{\binom{11}{3}} \approx 0,495$

c  
d

78

a  $1 - 0,99^{62} \approx 0,464$

b  $1 - 0,999^{62} \approx 0,060$

79

a  $p = 0,9$   $18$   $20 \cdot p = 18$

b  $\binom{20}{17} \cdot 0,9^{17} \cdot 0,1^3 \approx 0,1901$

c  $0,28 + 0,27 + 0,13 = 0,68$

80

a 2 6 4 8

b  $\frac{10}{0,2 \quad 0,8} \quad 0,4 \quad 0,6$   
 $\frac{2 \quad 8}{8 \quad 2}$

c 0,5

### Cumulatieve binomiale kansen

81

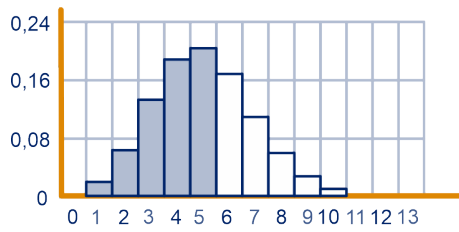
a  $0,0032 + 0,0211 + 0,0670 = 0,0913$

b  $k = 3$

c  $(X = 10) = (X \leq 10) - (X \leq 9) = 0,9961 - 0,9861 = 0,0100$

## 4 Kansen\_2

d



0

0

e

82

a  $0,2024 + 0,1686 + 0,1124 + 0,0609 + 0,0270 = 0,5713$

b  $(X \leq 10) - (X \leq 4) = 0,9861 - 0,4148 = 0,5713$

c

83

$$(X = 4) = (X \leq 4) - (X \leq 3) = 0,1382 \quad (X > 3) = 1 - (X \leq 3) = 0,1792$$

$$(2 \leq X \leq 5) = (X \leq 5) - (X \leq 1) = 0,7626$$

84

$$(X \leq k | p = \dots; \dots)$$

$$(X < 7 | p = 0,15; n = 14) = (X \leq 6 | p = 0,15; n = 14) = 0,9978$$

$$(1 < X < 4 | p = 0,25; n = 14) = (X \leq 3 | p = 0,25; n = 14) - (X \leq 1 | p = 0,25; n = 14) = 0,4203$$

$$(4 \leq X \leq 7 | p = 0,30; n = 14) = (X \leq 7 | p = 0,30; n = 14) - (X \leq 3 | p = 0,30; n = 14) = 0,6133$$

$$(X \geq 4 | p = 0,40; n = 20) = 1 - (X \leq 3 | p = 0,40; n = 20) = 0,9840$$

85

a  $n = 10$  succes = 6  $p = \frac{1}{6}$

b  $(X \geq 3 | n = 10; p = \frac{1}{6})$

c  $(X \geq 3 | n = 10; p = \frac{1}{6}) = 1 - (X \leq 2 | n = 10; p = \frac{1}{6}) = 0,2248$

86

a  $(X \geq 13 | n = 100; p = 0,1) = 1 - (X \leq 12 | n = 100; p = 0,1) = 0,1982$

b  $(X \geq 1 | n = 100; p = 0,01) = 1 - (X = 0 | n = 100; p = 0,01) = 0,6340$

87

a  $(X \geq 8 | n = 15; p = 0,4) = 1 - (X \leq 7 | n = 15; p = 0,4) = 0,2131$

b  $(X = 6 | n = 12; p = 0,6) = (X \leq 6 | n = 12; p = 0,6) - (X \leq 5 | n = 12; p = 0,6)$

$$= 0,2131 \quad \binom{12}{6} \cdot 0,6^6 \cdot 0,4^6 = 0,2131$$

88

a  $(4 \leq X \leq 6 | n = 10; p = 0,5)$

$$= (X \leq 6 | n = 10; p = 0,5) - (X \leq 3 | n = 10; p = 0,5) = 0,6562$$

6562

62



# 4 Kansen\_2

$$\begin{aligned} & 100 \\ & (40 \leq X \leq 60 | n = 100; p = 0,5) \\ & = (X \leq 60 | n = 100; p = 0,5) - (X \leq 39 | n = 100; p = 0,5) = 0,9648 \end{aligned}$$

89

a  $(X > 4 | n = 20; p = 0,15) = 1 - (X \leq 4 | n = 20; p = 0,15) = 0,1702$   
 b

90

a  $X$   $(X \geq 5 | n = 50; p = 0,05) = 1 - (X \leq 4 | n = 50; p = 0,05) = 0,1036$   
 b  $0,95^{50} \cdot 50 \approx 4$

91

a  $X$   $(X \geq 8 | n = 20; p = 0,25) = 1 - (X \leq 7 | n = 20; p = 0,25) = 0,1018$   
 b  $x$   
 $(X \geq x | n = 20; p = 0,25) = 1 - (X \leq x - 1 | n = 20; p = 0,25) = 0,01 \Leftrightarrow$   
 $(X \leq x - 1 | n = 20; p = 0,25) = 0,99$   
 $x - 1 = 9 \quad x = 10$

92

a  $\binom{12}{4} \cdot 0,15^4 \cdot 0,85^8 \approx 0,068$   
 b  $(40 \times 0,05 \times 50) + (40 \times 0,10 \times 10) = 140$

93

$$(X \geq 15 | n = 18; p = 0,7) = 1 - (X \leq 14 | n = 18; p = 0,7) = 0,1646$$

94

a  $X$   $(X \geq 18 | n = 20; p = 0,9) = 1 - (X \leq 17 | n = 20; p = 0,9) = 0,6769$   
 b  $(X < 45 | n = 50; p = 0,9) = (X \leq 44 | n = 50; p = 0,9) = 0,3839$

95

a  $X$   $(X \leq 17 | n = 20; p = 0,95) = 0,0755$   
 b  $0,0755 \cdot 0,60 \cdot 1000 = 45$   
 $(X \leq 44 | n = 50; p = 0,95) = 0,0378$   
 $0,0378 \cdot 0,60 \cdot 1500 = 34$

96

a  $0,95^2 \cdot 0,05^2 = 0,00226$   $0,95^2 \cdot 0,05^2 = 0,00226$   
 b  $0,95^4 = 0,814$   
 c  $\binom{4}{1} \cdot 0,95^3 \cdot 0,05 = 0,171$   
 d  $1 - 0,95^4 = 0,18549$   
 $10.000 \cdot 0,18549 = 1855$

97

a  $0,95^3 + \binom{3}{1} \cdot 0,95^2 \cdot 0,05 = 0,9928$

b  $0,9928^4 = 0,9715$

c

d  $\binom{5}{2} \cdot 0,95^3 \cdot 0,05^2 + \binom{5}{1} \cdot 0,95^4 \cdot 0,05 + 0,95^5 = 0,9988$

e  $0,9988^4 = 0,9954$

f

**Met en zonder terugleggen**

$$a \quad (S=0) = \frac{\binom{8}{2} \cdot \binom{2}{0}}{\binom{10}{2}} = \frac{28}{45} \quad (S=1) = \frac{\binom{8}{1} \cdot \binom{2}{1}}{\binom{16}{2}} = \frac{16}{45} \quad (S=2) = \frac{\binom{8}{0} \cdot \binom{2}{2}}{\binom{1}{2}} = \frac{1}{45}$$

$$(S=0) \approx 0,6222 \quad (S=1) \approx 0,3556 \quad (S=2) \approx 0,0222$$

$$b \quad (S=0) = \binom{2}{0} \cdot 0,2^0 \cdot 0,8^2 = 0,64 \quad (S=1) = \binom{2}{1} \cdot 0,2^1 \cdot 0,8^1 = 0,32$$

$$(S=2) = \binom{2}{2} \cdot 0,2^2 \cdot 0,8^0 = 0,04$$

98

99

$$(S=0) = \frac{\binom{800}{2} \cdot \binom{200}{0}}{\binom{1000}{2}} = \frac{319.600}{499.500} \approx 0,6398...$$

$$(S=1) = \frac{\binom{800}{1} \cdot \binom{200}{1}}{\binom{1000}{2}} = \frac{160.000}{499.500} \approx 0,3203...$$

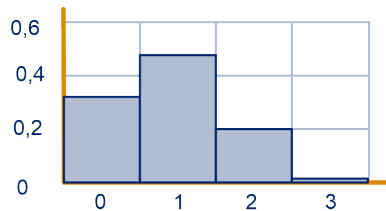
$$(S=2) = \frac{\binom{800}{0} \cdot \binom{200}{2}}{\binom{1000}{2}} = \frac{19.900}{499.500} \approx 0,0398...$$

100

# 4 Kansen\_2

101

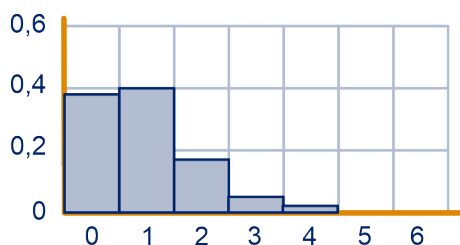
a  
b



c  $= 1 \cdot 0,47 + 2 \cdot 0,18 + 3 \cdot 0,02 = 0,89$

102

a  
b



c  $= 1 \cdot 0,3993 + 2 \cdot 0,1762 + 3 \cdot 0,0415 + 4 \cdot 0,0055 + 5 \cdot 0,00038 + 6 \cdot 0,0000114 = 0,9001684$

103

a  $X$   $(X \leq 3 | n = 10; p = 0,05)$

b  $\frac{\binom{7}{5} \cdot \binom{3}{0}}{\binom{10}{5}} = 0,0833\dots \quad \frac{7}{10} \cdot \frac{6}{9} \cdot \frac{5}{8} \cdot \frac{4}{7} \cdot \frac{3}{6} = \frac{1}{12}$

c  $\left(\frac{7}{10}\right)^5 = 0,1681$

104

$\frac{4}{5} \cdot \frac{3}{4} \cdot \frac{1}{3} = \frac{1}{5}$

105

*met terugleggen*

$X$   $(X \geq 10 | n = 17; p = 0,5) = 0,3145$

## Extra opgaven

1

a  $X$   $(160 < X < 200 | = 182; = 9) = 0,97$   
 $0,03 \cdot 95.000 = 2850$

b  $(160 < X < 175 | = 182; = 9) = 0,2111 \quad 0,2111 \cdot 95.000 = 20.054$   
 $(175 < X < 185 | = 182; = 9) = 0,4122 \quad 0,4122 \cdot 95.000 = 39.160$   
 $(175 < X < 200 | = 182; = 9) = 0,3467 \quad 0,3467 \cdot 95.000 = 32.936$

c  $(x < X < 200 | = 182; = 9) = 0,9474 \quad (x < X | = 182; = 9) = \frac{90.000}{95.000} = 0,9474$   
 $0,9474 + (X > 200 | = 182; = 9) = 0,9474 + 0,0228 = 0,9702$

## 4 Kansen\_2

$$0,03 \quad x = 165,1 \quad x \quad (x < X | = 182; = 9) = 1 - 0,9702 \approx$$

$$115; = 13) = 0,85 \quad x \quad (X > x | = 115; = 13) = 0,15 \quad (X < x | =$$

$$x = 128,5$$

$$x \quad (145 < X < 155 | = 150; = x) = 0,9$$

$$(X < 155 | = 150; = x) = 0,95$$

$$z \quad x$$

$$0,95 \quad 1,64 \quad \frac{155 - 150}{x} = 1,64 \Leftrightarrow x = \frac{5}{1,64} = 3,05$$

$$3,05$$

$$x \quad (X < 1 | = 1,03; = x) = 0,028$$

$$z \quad x$$

$$0,028 \quad -1,90 \quad -1,90 = \frac{1 - 1,03}{x} \Leftrightarrow x = \frac{0,03}{1,90} = 0,0157$$

$$z \quad 20 \quad 40 \quad 60 \quad 80$$

$$-0,84 \quad -0,25 \quad 0,25 \quad 0,84$$

$$0,25 \quad x \quad 0,84 \quad y \quad \frac{x - 80}{15} = 0,25 \Leftrightarrow x =$$

$$80 + 0,25 \cdot 15 = 83 \quad \frac{y - 80}{15} = 0,84 \Leftrightarrow y = 80 + 0,84 \cdot 15 = 92,6$$

$$67,4 \quad 77$$

$$(3,6 \leq X \leq 4,4 | = 4; = 0,2) = 1 - 2 \cdot (X \leq 3,6 | = 4; = 0,2) = 0,9545 \quad 95,45$$

$$\frac{1500}{95,45} = 15,7$$

$$(3,6 \leq X \leq 4,4 | = 4; = 0,2) = 1 - 2 \cdot (X \leq 3,6 | = 4; = 0,3) = 0,8176 \quad 81,76$$

$$\frac{1300}{81,76} = 15,9$$

$$\mathbf{a} \quad (X \geq 36 | = 33; = 2,7) = 1 - (X \leq 36 | = 33; = 2,7) = 0,133 \quad 13,3$$

$$\mathbf{b} \quad x \quad (X \geq 51,5 | = 45; = x) = 0,001$$

$$z \quad 0,999 \quad 3,1 \quad \frac{51,5 - 45}{x} = 3,1 \Leftrightarrow x = \frac{6,5}{3,1} = 2,1$$

**c**

$$\frac{m - 33}{2,7} = 3,1 \Leftrightarrow m = 33 + 2,7 \cdot 3,1 = 41,4$$

$$(X \geq 41,4 | = 45; = 2,1) = 1 - (X \leq 41,4 | = 45; = 2,1) = 0,96$$

$$96$$

$$\mathbf{a} \quad (X \leq 2500 | = 2540; = 80) = 0,3085$$

$$\mathbf{b} \quad 0,3085^5 = 0,0028$$

## 4 Kansen\_2

c

2500

z            0,6    0,2533     $\frac{x - 40.000}{6515} = 0,2533 \Leftrightarrow x = 6515 + 0,2533 \cdot 6515 = 41.651$      $(X \geq 40.000 | n = 6515; p = 0,6)$

9

10

a

b  $2^7 = 128$

c  $2^5 = 32$      $128 - 32 = 96$

d

11

a

b            90

c

d             $\rightarrow$     90  $\rightarrow$             2  $\rightarrow$

12

a  $2^5 = 32$

b

c

d

13

a

b

60

$$(X \geq 30 | n = 50; p = \frac{1}{2}) = 1 - (X \leq 29 | n = 50; p = \frac{1}{2}) = 0,1013 \\ = 52 \cdot 0,1013 = 5,27$$

$$(X \geq 12 | n = 20; p = \frac{1}{2}) = 1 - (X \leq 11 | n = 20; p = \frac{1}{2}) = 0,2517 \\ = 52 \cdot 0,2517 = 13,09$$

14

15

a

$$8 \cdot 7 = 56$$

b

c  $56 + 8 + 8 = 72$

16

a  $\binom{20}{14} \cdot 0,7^{14} \cdot 0,3^6 = 0,1916$

b  $(11 \leq X \leq 15 | n = 20; p = 0,7)$

$$= (X \leq 15 | n = 20; p = 0,7) - (X \leq 10 | n = 20; p = 0,7) = 0,7145$$

17

a  $\binom{12}{3} = 220$

b 220

## 4 Kansen\_2

$$c \quad \binom{8}{3} \cdot \binom{4}{0} \binom{8}{2} \cdot \binom{4}{1} \binom{8}{1} \cdot \binom{4}{2} \quad \binom{8}{0} \cdot \binom{4}{3}$$

$$d \quad \frac{\binom{8}{1} \cdot \binom{4}{2}}{\binom{8}{3}} = \frac{48}{220} = \frac{12}{55}$$

18

$$(X < 5 | n = 50; p = 0,1) = (X \leq 4 | n = 50; p = 0,1) = 0,4312$$

19

$$= \quad = \quad = \quad = \quad = \quad = \quad =$$

20

$$a \quad 11! = 39916800$$

$$b \quad 10! = 3628800$$

$$c \quad 5 \cdot 10! = 18144000$$

21

a

b

$$0,8 \cdot 0,95 = 0,76$$

c 0

$$1 - 0,76 = 0,24$$

$$0,76^4 = 0,3336$$

1

$$\binom{4}{1} \cdot 0,24 \cdot 0,76^3 = 0,4214$$

2

$$\binom{4}{2} \cdot 0,24^2 \cdot 0,76^2 = 0,1996$$

3

$$\binom{4}{3} \cdot 0,24^3 \cdot 0,76 = 0,0420$$

4

$$0,24^4 = 0,0033$$

$$d \quad 0,3336 \cdot 0 + 0,4214 \cdot 1 + 0,1996 \cdot 2 + 0,0420 \cdot 3 + 0,0033 \cdot 4 = 0,96$$

$$e \quad 40 \cdot 0,96 = 38,4$$

22

$$a \quad \binom{52}{13} \approx 635$$

$$b \quad 4 \cdot \binom{13}{4} \cdot \binom{13}{3}^3 \approx 66,9$$

$$c \quad \approx \frac{66,9}{635} \approx 10,5$$

d

$$2^4 = 16$$

$$e \quad \binom{4}{2} = 6$$

23

$$a \quad \frac{16}{0,2956}$$

$$\frac{16}{29} \cdot \frac{15}{28} =$$

b

$$\frac{21}{29}$$

$$(X > 50 | n = 100; p = \frac{21}{29}) \approx 1,000$$

# 4 Kansen\_2

24

c  $1 \cdot \frac{4}{29} + 2 \cdot \frac{9}{29} + 3 \cdot \frac{8}{29} + 4 \cdot \frac{5}{29} + 5 \cdot \frac{2}{29} + 6 \cdot \frac{1}{29} = \frac{82}{29} \approx 2,83$

a 1 10

b  $0,95^{10} = 0,60$

c  $0,60 \cdot 1 + 0,40 \cdot 11 = 5$

d 10  $5 \cdot 25 = 125$

25

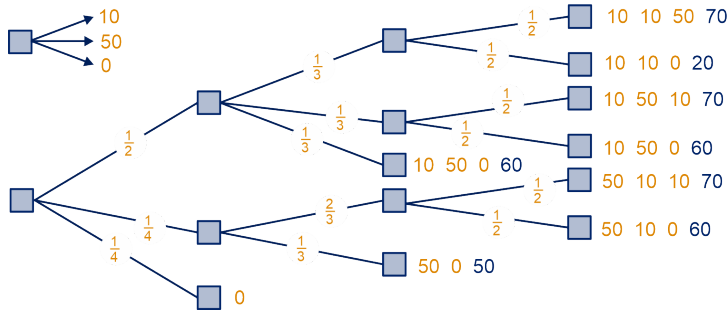
a  $0,96^4 = 0,85$

b  $\binom{4}{2} \cdot 0,96^2 \cdot 0,04^2 = 0,0088$

c  $\binom{4}{0} \cdot 0,96^4 \cdot 144 + \binom{4}{1} \cdot 0,96^3 \cdot 0,04 \cdot 140 + \binom{4}{2} \cdot 0,96^2 \cdot 0,04^2 \cdot 136 + \binom{4}{3} \cdot 0,96 \cdot 0,04^3 \cdot 132 + \binom{4}{4} \cdot 0,04^4 \cdot 128 = 143,37$

26

a



b  $\frac{1}{2} \cdot \frac{1}{3} \cdot \frac{1}{4} = \frac{1}{24}$

c  $\frac{3}{4} \cdot \frac{1}{3} = \frac{1}{4}$

d

	0	10	20	50	60	60
	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{4}$

e  $0 \cdot \frac{1}{4} + 10 \cdot \frac{1}{6} + 20 \cdot \frac{1}{12} + 50 \cdot \frac{1}{12} + 60 \cdot \frac{1}{6} + 70 \cdot \frac{1}{4} = 35$

27

a  $0,8^5 \approx 0,33$

b  $1 - 0,33 = 0,67$

28

a  $0,001 \cdot 1000 + 0,002 \cdot 100 + 0,003 \cdot 25 = 1,275$

b 1000 0,002

c  $1 - \frac{994}{1000} \cdot \frac{993}{999} \cdot \frac{992}{998} \cdot \frac{991}{997} \approx 0,02382$

29

**a**  $\left(\frac{5}{6}\right)^4 = 0,4823$

**b**  $\left(\frac{35}{36}\right)^{24} = 0,5036$



4 Kansen\_2

0

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