Lösungen / Statistik 1/13

1.

```
Remove["Global`*"]
```

A $\bigcap$ B = {}, A $\bigcup$ B =

X= Ereignis Schwarzfahrer zu ergreifen = événement de trouver un sans billet

a = P(X|A), b = P(X|B)

aA=P(A); bB=P(B); xX=P(X)

X=(A$\bigcap$X)$\bigcup$(B$\bigcap$X); (A$\bigcap$X)$\bigcap$(B$\bigcap$X)={};

P(X)=P(A$\bigcap$X)+P(B$\bigcap$X);

P(A$\bigcap$X) = P(A) P(X|A);

P(B$\bigcap$X) = P(B) P(X|B);

```
a = 0.1; b = 0.02;
aA = 4000 / (4000 + 2000); bB = 2000 / (4000 + 2000);
xX = aA * a + bB * b

0.0733333
```

2.

```
Remove["Global`*"]
```

c=P(X|C); cC=P(C);

P(C$\bigcap$X)=P(X)*P(C|X)=P(C)*P(X|C)

d=P(C|X)= P(C)*P(X|C)/P(X)= P(C)*P(X|C)/(P(A$\bigcap$X)+P(B$\bigcap$X)+P(C$\bigcap$X))

= P(C)*P(X|C)/(P(A) P(X|A)+ P(B) P(X|B)+ P(C) P(X|C))

=cC * c /(aA * a + bB * b + cC * c)

```
aA = 4000 / (1000 + 4000 + 2000);
bB = 2000 / (1000 + 4000 + 2000);
cC = 1000 / (1000 + 4000 + 2000);
a = 0.1; b = 0.02;
c = 0.015;


d = cC * c / (aA * a + bB * b + cC * c)

0.032967
```

3.

Antworten vergleiche angegebene Skripte oder

http://rowicus.ch/Wir/ProblemsSolutBachelor/Statistik/StatistikFragenZuVerteilungen.pdf

---

4.

```
Remove["Global`*"]

p = 0.3;
q = 1 - p;
B[n_, k_, p_] := Binomial[n, k] p^k (1 - p) ^ (n - k)
```
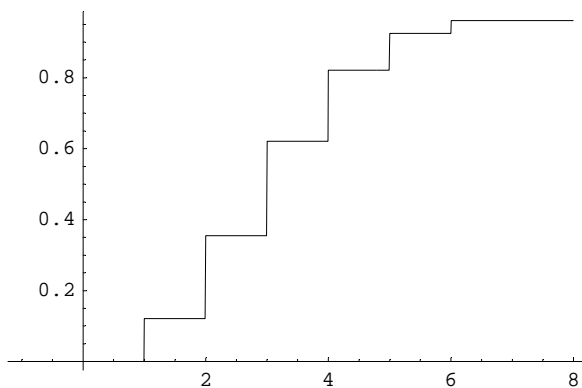
a

```
B[10, 4, 0.3]
```

0.200121

b

```
h[x_] := Sign[(Sign[x] + 1) / 2];
P[x_] := B[10, x, 0.3];
t[x_] := x;
F[x_] := Sum[P[k] h[x - t[k]], {k, 1, 6}];
F[x]
```

$0.0367569\, \text{Sign}[1 + \text{Sign}[-6 + x]] + 0.102919\, \text{Sign}[1 + \text{Sign}[-5 + x]] +$
$0.200121\, \text{Sign}[1 + \text{Sign}[-4 + x]] + 0.266828\, \text{Sign}[1 + \text{Sign}[-3 + x]] +$
$0.233474\, \text{Sign}[1 + \text{Sign}[-2 + x]] + 0.121061\, \text{Sign}[1 + \text{Sign}[-1 + x]]$

```
Plot[F[x], {x, -1, 8}];
```

```
F[4.5] - F[3.5]
```

```
0.200121
```

```
B[10, 4, 0.3] == F[4.5] - F[3.5]
```

```
True
```

5.

```
Remove["Global`*"]
```

```
n = 20;
p = 2 / 10;
q = 1 - p;
B[n_, k_, p_] := Binomial[n, k] p^k (1 - p) ^ (n - k);
```

a

```
P[x ≤ 5]
```

```
P[x ≤ 5]
```

P[x ≥ 5] = 1 - P[x ≤ 4] = 1 - B[n,4,p] - B[n,3,p] - B[n,2,p] - B[n,1,p] - B[n,0,p]

```
1 - B[n, 4, p] - B[n, 3, p] - B[n, 2, p] - B[n, 1, p] - B[n, 0, p] // N
```

```
0.370352
```

b

```
EW = n p // N
```

```
4.
```

```
StAbw = Sqrt[n p q] // N
```

```
1.78885
```

6.

```
Remove["Global`*"]
```

Beim Bernoulli-Experiment war B[n,k,p] die Anzahl der erfolgreichen Versuche bei insgesamt n Versuchen. Bei welchen Versuchnummern die Erfolge eintreffen wird ausser Acht gelassen. Die Kombinationen (Binomialkoeffizienten) in der Formel zeigen an, dass man alle alle Möglichkeiten auswählt.

Beim geometrischen Modell dagegen fragt man nach der Chance bis zum 1. Misserfollg beim k-ten Versuch. Die dazugehörige Wahrscheinlichkeit ist somit
$P[\,X = k\,] = p\,p\,p\,p \ldots p\,q = p^{(k-1)}\,(1 - p)$

```
Sum[p^(k-1) (1-p), {k, 1, n}] // Simplify
```

$1 - p^n$

```
n = 20;
p = 9/10;
B[n_, p_] := 1 - p^n;
```

$P[X > 20] = 1 - P[X \quad 20]$

a

```
B[n, p] // N
```

```
0.878423
```

b

```
1 - B[n, p] // N
```

```
0.121577
```

c

```
EW = 1/p // N
```

```
1.11111
```

```
StAbw = Sqrt[1/p^2 - 1/p] // N
```

```
0.351364
```

7.

```
Remove["Global`*"]

H[n1_, n2_, m_, k_] := Binomial[n1, k] Binomial[n2, m - k] / Binomial[n1 + n2, m]
```

a

```
n1 = 4;
n2 = 26;
m = 5;
```

```
H[n1, n2, m, 2] // N
```

```
0.109469
```

b

b1

```
n1 = 3;
n2 = 100 - 3;
m = 10;

H[n1, n2, m, 0] // N
```
```
0.726531
```

b2

```
n1 = 3;
n2 = 100 - 3;
m = 10;

H[n1, n2, m, 1] // N
```
```
0.247681
```

b3

```
n1 = 3;
n2 = 100 - 3;
m = 10;

H[n1, n2, m, 2] // N
```
```
0.0250464
```

b4

```
n1 = 3;
n2 = 100 - 3;
m = 10;

H[n1, n2, m, 3] // N
```
```
0.000742115
```

b5

```
n1 = 3;
n2 = 100 - 3;
m = 10;

EW = m n1 / (n1 + n2) // N
```
```
0.3
```

```
StAbw = Sqrt[EW (1 - n1 / (n1 + n2)) ((n1 + n2 - m) / (n1 + n2 - 1))] // N
```

0.51434