Oskar Bujacz lista 3 RPiS

1. zadanie 2 lista 3

```
from datetime import datetime
import numpy as np

week_days = np.zeros(7)
for year in range(1601,2001):
    for month in range(1,13):
        for i in range(0,7):
            if datetime(year,month,13).weekday()==i:
                week_days[i]+=1
print(week_days)
```

```
[685. 685. 687. 684. 688. 684. 687.]
```

2. zadanie 10 lista 3

definicja wariancji i wartości oczekiwanej

$$VX = V(X) = \sum_i (x_i - EX)^2 p_i$$

$$EX = E(X) = \sum_i x_i p_i = \sum_k k(1-p)^{k-1} p$$

skorzystamy z własności

$$V(X) = E(X^2) - (E(X))^2$$

rozpiszmy $E(X)$

$$E(X) = p\sum_k (1-p)^{k-1} = p\sum_k \left(-(1-p)^k\right)' = p\left(-\sum_k (1-p)^k\right)' =$$

zauważmy, że mamy sumę szeregu geometrycznego

$$= p\left(\frac{1-p}{1-(1-p)}\right)' = p\left(\frac{p-1}{p}\right)' = p\left(\frac{p-p+1}{p^2}\right) = \frac{p}{p^2} = \frac{1}{p}$$

rozpiszmy $E(X^2)$

$$E(X^2) = p\sum_k k^2(1-p)^{k-1} = p\left(-\sum_k k(1-p)^k\right)' = p\left(-\left(\sum_k k(1-p)^k \frac{p}{1-p}\frac{1-p}{p}\right)\right)' =$$

$$= p\left(-\frac{1-p}{p}\left(\sum_k kp(1-p)^{k-1}\right)\right)' =$$

sumę zapiszmy jako wartość oczekiwaną

$$= p\left(\frac{p^2-(p-1)2p}{p^4}\right) = \frac{p^2-2p^2+2p}{p^3} = \frac{2p-p^2}{p^3} = \frac{2-p}{p^2}$$

zatem

$$V(X) = \frac{2-p}{p^2} - \frac{1}{p^2} = \frac{1-p}{p^2}$$