Exercise 1:

a) Binomial coefficient:

$$C(52,5) = \frac{52!}{5!(52-5)!} \approx \underline{\underline{2598960}}$$

b) $$P(\text{atomic event}) = \frac{1}{C(52,5)} = \underline{\underline{\frac{1}{2598960}}}$$

c) One possible Royale Straight Fluch for each card type

$$\rightarrow P(\text{Royale Straight Fluch}) = \frac{4}{C(52,5)} = \underline{\underline{\frac{1}{649740}}}$$

$$P(\text{Four of a kind}) = \frac{(C(13,1) \times C(4,4)) \cdot (C(12,1) \times C(4,1))}{C(52,5)}$$

$$= \frac{\left(\frac{13!}{1!\,12!} \times 1\right) \cdot \left(\frac{12!}{1!\,11!} \times \frac{4!}{1!\,3!}\right)}{C(52,5)} = \frac{13 \cdot 48}{2598960}$$

$$= \underline{\underline{0{,}000240}}$$

Exercise 2:

a)

One Bar, Bell, Lemon and Cherry at each of the 3 independent wheels i.e $\frac{1}{4}$ is the probability for any one at each wheel.

$$P(20\,coin) = P(X_1 = Bar \wedge X_2 = Bar \wedge X_3 = Bar)$$

$$= P(X_1 = Bar)\,P(X_2 = Bar)\,P(X_3 = Bar)$$

$$= \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{64}$$

$$P(15\,coin) = P(X_1 = Bell \wedge X_2 = Bell \wedge X_3 = Bell) = \frac{1}{64}$$

$$P(5\,coin) = P(X_1 = Lemon \wedge X_2 = Lemon \wedge X_3 = Lemon) = \frac{1}{64}$$

$$P(3\,coin) = P(X_1 = Cherry \wedge X_2 = Cherry \wedge X_3 = Cherry) = \frac{1}{64}$$

$$P(2\,coin) = P(X_1 = Cherry \wedge X_2 = Cherry \wedge X_3 \neq Cherry) = \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{3}{4} = \frac{3}{64}$$

$$P(1\,coin) = P(X_1 = Cherry \wedge X_2 \neq Cherry \wedge X_3 \neq Cherry) = \frac{1}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} = \frac{9}{64}$$

P(Expected Payback)

$$= 20 \cdot P(20\,coin) + 15 \cdot P(15\,coin) + 5 \cdot P(5\,coin)$$

$$+ 3 \cdot P(3\,coin) + 2 \cdot P(2\,coin) + 1 \cdot P(1\,coin) + 0 \cdot P$$

$$= \underline{\underline{0{,}906250}}$$

b)

Assuming only getting 1 coin back on the 1 coin bet is a win.

$$P(\text{win}) = P(20\text{ coin}) + P(15\text{ coin}) + P(5\text{ coin}) + P(3\text{ coin}) + P(2\text{ coin}) + P(1\text{ coin})$$

$$= \frac{16}{64} = \underline{\underline{0{,}25}}$$

c) Assignment1TDT4171.py

Results;

Mean: 227

Median: 21

Exercise 3:

Part 1 results;

Smallest N simulated to be 23

Part 2 results;

Average simulated group size needed; 2360