2) Probability Distributions

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Exercise 2.1

```
## Random sample of size n=10 of N(0,1)-Distribution
x1 = rnorm(n = 10, mean = 0, sd = 1)
hist(x1, breaks=3)
## Random sample of size n=100 of N(0,1)-Distribution
x2 = rnorm(n = 100, mean = 0, sd = 1)
hist(x2, breaks=3)
## Random sample of size n=1000 of N(0,1)-Distribution
x3 = rnorm(n = 1000, mean = 0, sd = 1)
hist(x3, breaks = 3)
```

Look at the three histograms and discuss them with your neighbour. Tune the `breaks` parameter. What is a reasonable choice? Type `rnorm` and `?hist` for further help.

Exercise 2.2

Assume, the survival probability of patients after brain surgery is exponentially distributed. Assume further that the average survival time of a patient is 36 months, $\lambda = 1/36$.

You can plot the density function of the exponential distribution by the following code:

```
x = seq(0, 200, length.out = 100)
y = dexp(x, rate = 1/36)
plot(x, y, type = "l", xlab = "months")
```

You can plot the cumulative distribution function of the exponential distribution by the following code:

```
x = seq(0, 200, length.out = 100)
y = pexp(x, rate = 1/36)
plot(x, y, type = "l", xlab = "months")
```

Determine the probability of a particular patient of surviving equal or shorter than 12 month. Use the R-function `pexp`. You get help by typing `?pexp`.

What is the probability of a particular patient of surviving longer than 5 years (i.e. 60 month)?

Exercise 2.3

Let the overall success probability of a therapy be $\pi = 0.7$. Determine the probability that $k = \{1, 4, 8\}$ OR LESS patients out of $n = 10$ will have a successful therapy. You can employ the R-function `pbinom`. You get help via `?pbinom`.

Determine the probability that EXACTLY $k = \{1, 4, 8\}$ patients out of $n = 10$ will have a successful therapy. You can employ the R-function `dbinom`. You get help via `?dbinom`.