

# Statistics tutorial 3 exercise 1

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## 1 task 1

### 1.1 task 1.d)

While playing with the boundary conditions one obtains that especially the boundary condition of the last entry of the F array changes a lot in performance. The last two points have a slope near to 0, which does not allow big numbers for this boundary condition. Otherwise you will get huge oscillations in the last few x-values! best boundary conditions found:

- $b[0]=1$ .
- $F[0]=0.5$
- $F[\text{last}]=0.0$

### 1.2 task 1.e)

The best solution gives the cubic spline interpolation, but only if you find the right boundary conditions. Otherwise you will get huge oscillations and the prediction of the interpolation routine will get really bad. This routine allows way better prediction of the solution because you take higher order of the polynomial Taylor expansion into account.

## 2 task 2

### 2.1 task 2 c)

For the Integral over  $f(x) = x$  it does not matter which numerical routine one applies. Because one integrates over a linear function, a linear interpolation like in the trapezoidal rule fits as good as the quadratic interpolation from the Simpson's rule.

For the integral over  $f(x) = x^2$  it is obvious that the quadratic interpolation from Simpson's rule approximates (in this case even more) the function better. So you get the true value.

In general the simpsons rule will return a better and precise result for a arbitrary function, because the quadratic interpolation is always more precise.