As part of an exercise in understanding B-spline, my professor assigned us a task. The task is to write a Matlab program that will plot the basis functions and the B-spline curve with given control points.

I'm stuck on plotting the B-spline.

open-B-spline is expressed as follows:

$$P(u) = \sum_{i=0}^{n} P_i N_{i,k}(u) \qquad 0 \le u \le u_{max}$$

Basis functions:

$$k > 1: \qquad N_{i,k}(u) = \frac{(u - t_i)N_{i,k-1}(u)}{t_{i+k-1} - t_i} + \frac{(t_{i+k} - u)N_{i+1,k-1}(u)}{t_{i+k} - t_{i+1}}$$

$$N_{i,1}(u) = \begin{cases} 1 & if \quad t_i \le u < t_{i+1} \\ 0 & otherwise \end{cases}$$

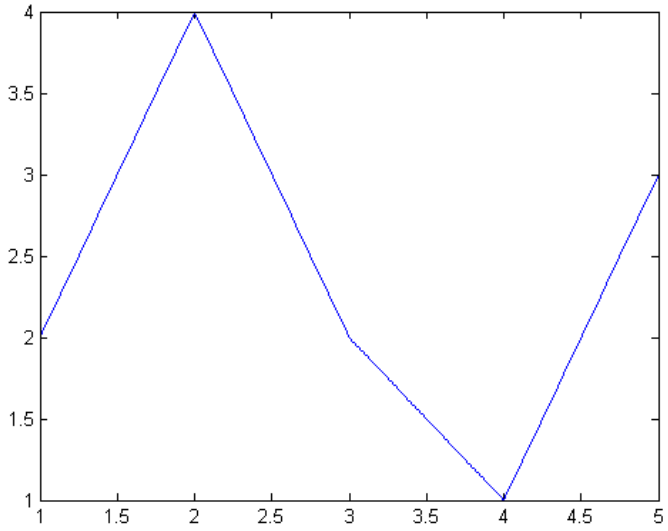
Example for testing:

N=4

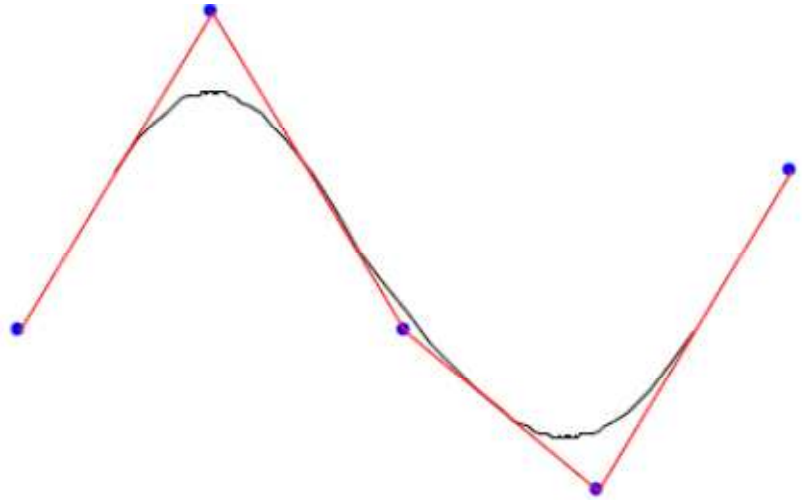
Order=3

P_i=(1,2),(2,4),(3,2),(4,1),(5,3)

Plot of linear segments

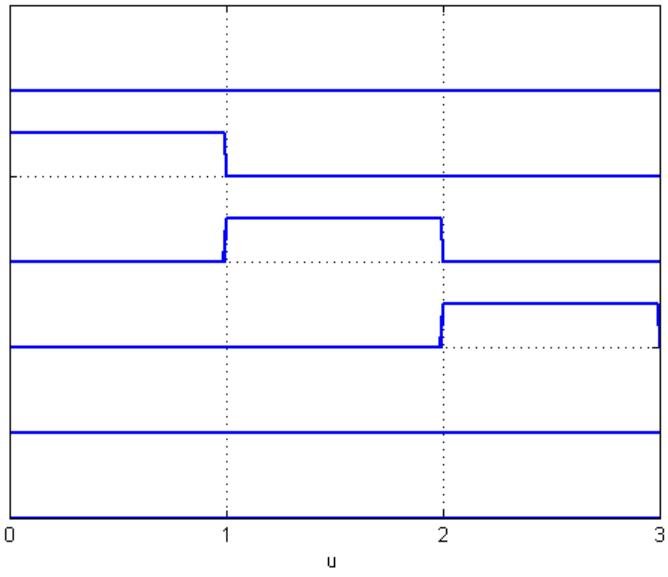


Plot of B-spline with linear segments.

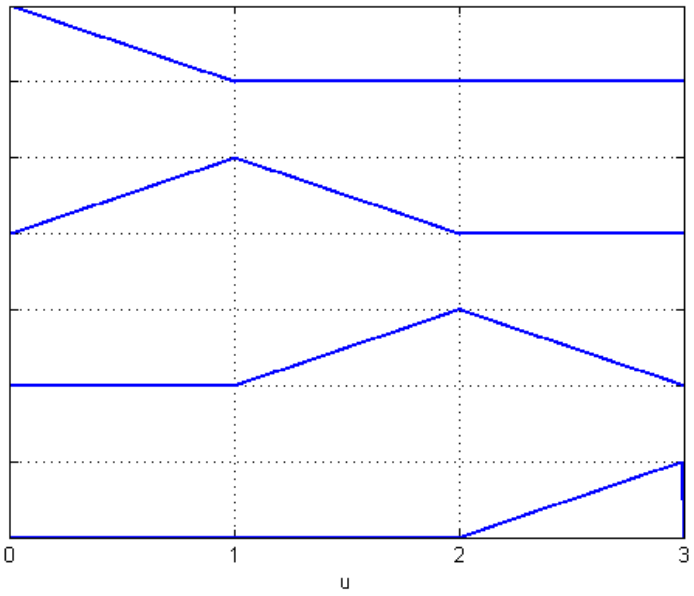


To create the B-spline curve, the basis functions need to be calculated. These are found for each k. The top line represents the first basis function and the bottom line is the last basis function.

K=1



K=2



K=3