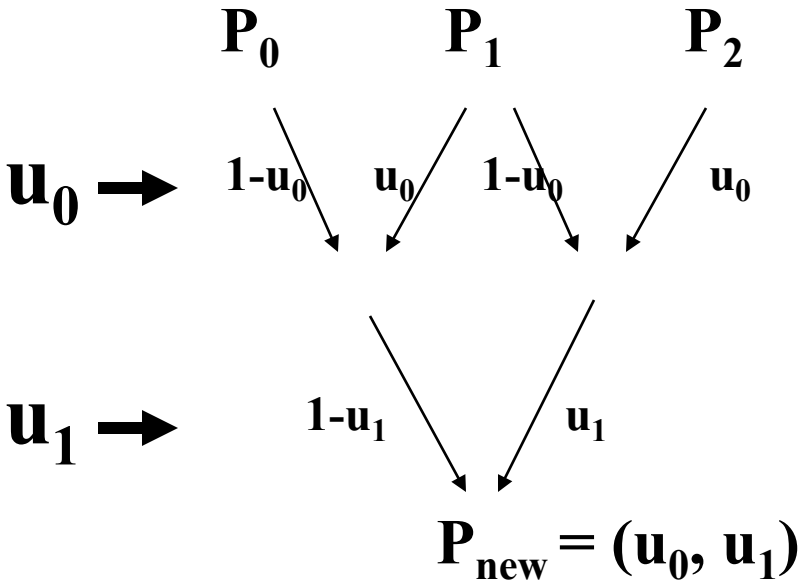
Outline

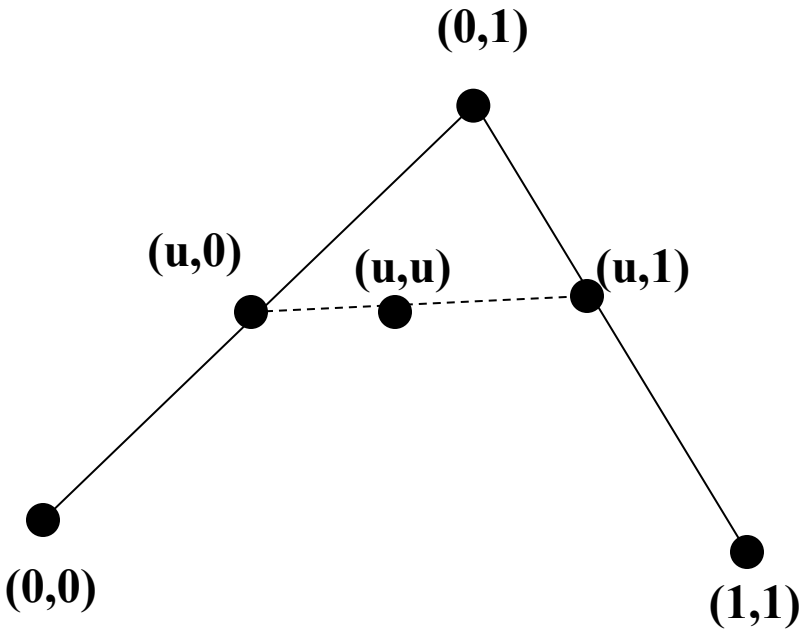
- What is polar form?
- B-Spline
  - Labeling, why (0,1,2), (1,2,3)… ?
  - Knot Vector, why (-2,-1,0,1,2,…) ?
- Derivation of B-Spline points
  - Maybe(Next Week?)

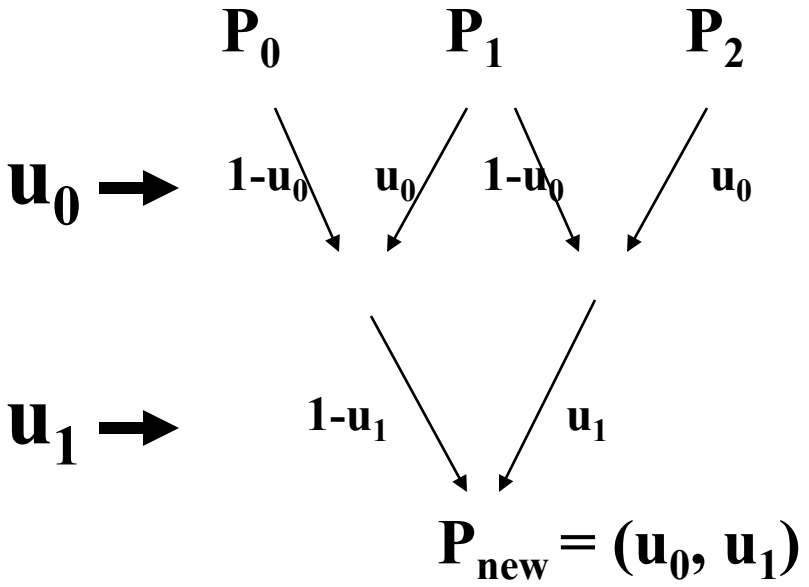
What is Polar Form Labeling?

- The sequences of parameters applied at each level of pyramid for de Casteljau evaluation.

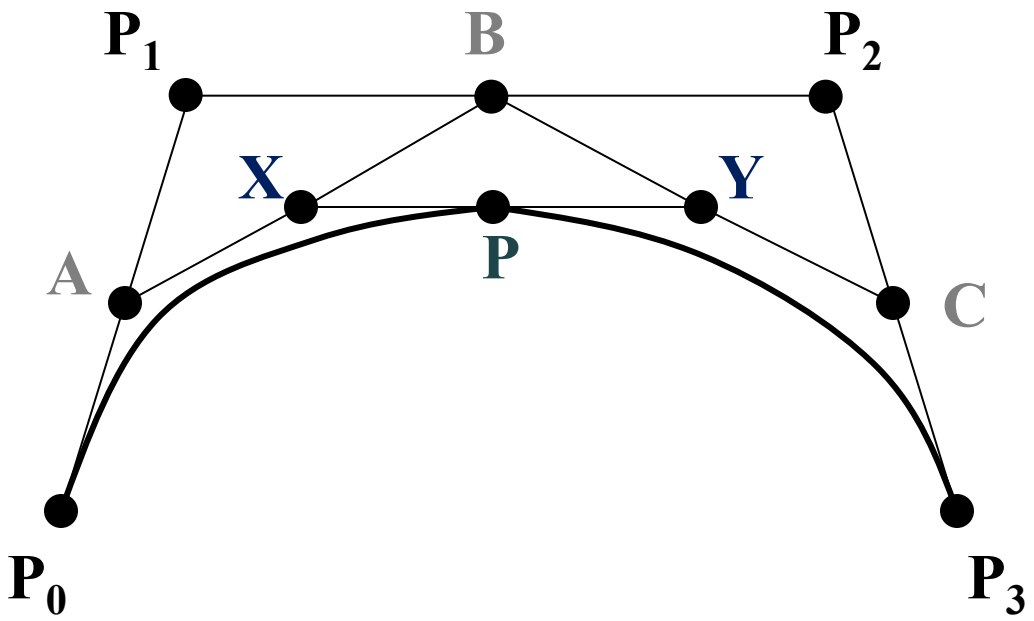


Polar Form for Quadratic Bezier





Quiz



(0, 0, 0) = P0

(0, 1, 1) = P2

(u, 0, 1) = B

(0, 0, 1) = ?

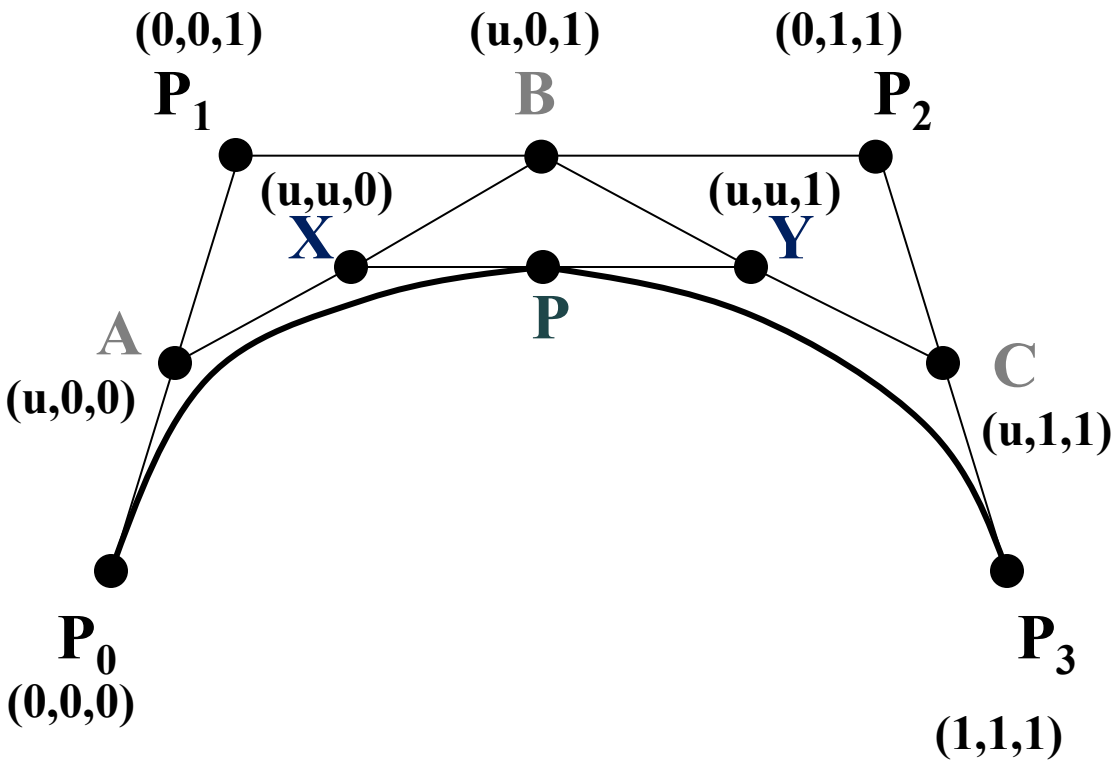
(u, 1, 1) = ?

(u, u, 0) = ?

(u, 0, 0) = ?

(u, u, u) = ?

Quiz



(0, 0, 0) = P0

(0, 1, 1) = P2

(u, 0, 1) = B

(0, 0, 1) = ?

(u, 1, 1) = ?

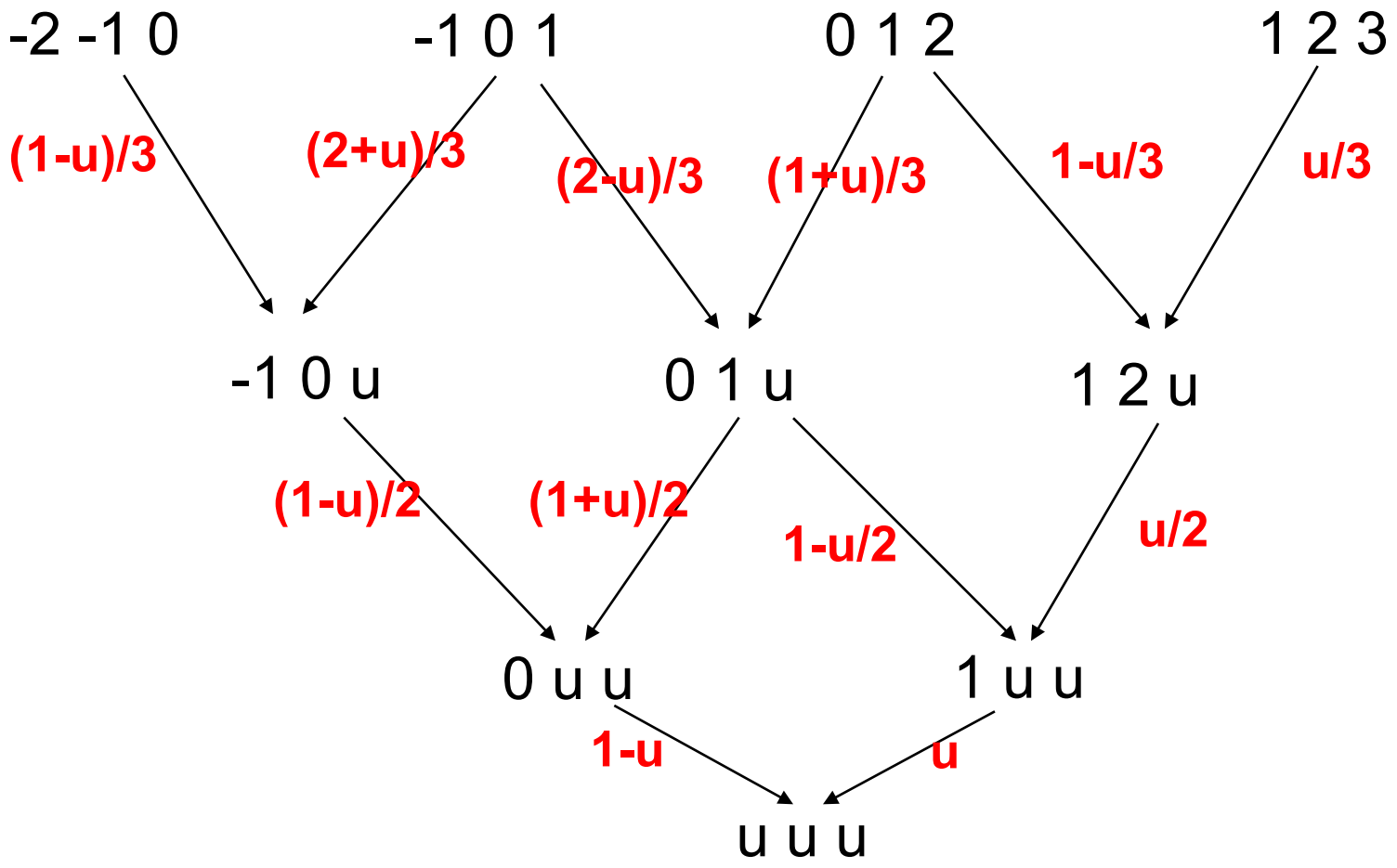
(u, u, 0) = ?

(u, 0, 0) = ?

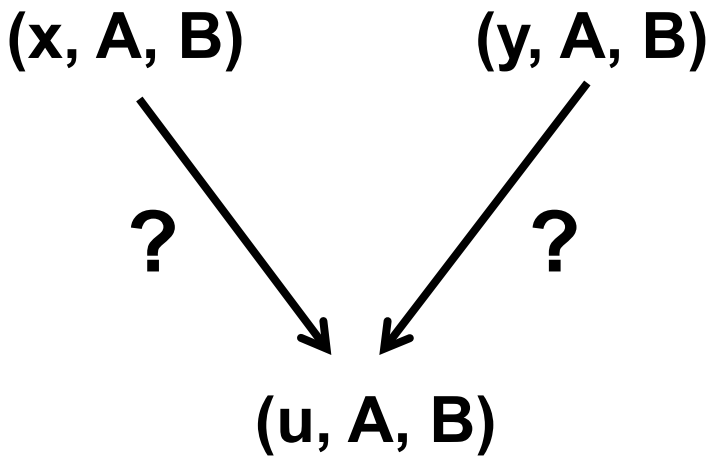
(u, u, u) = ?

March 13 2012

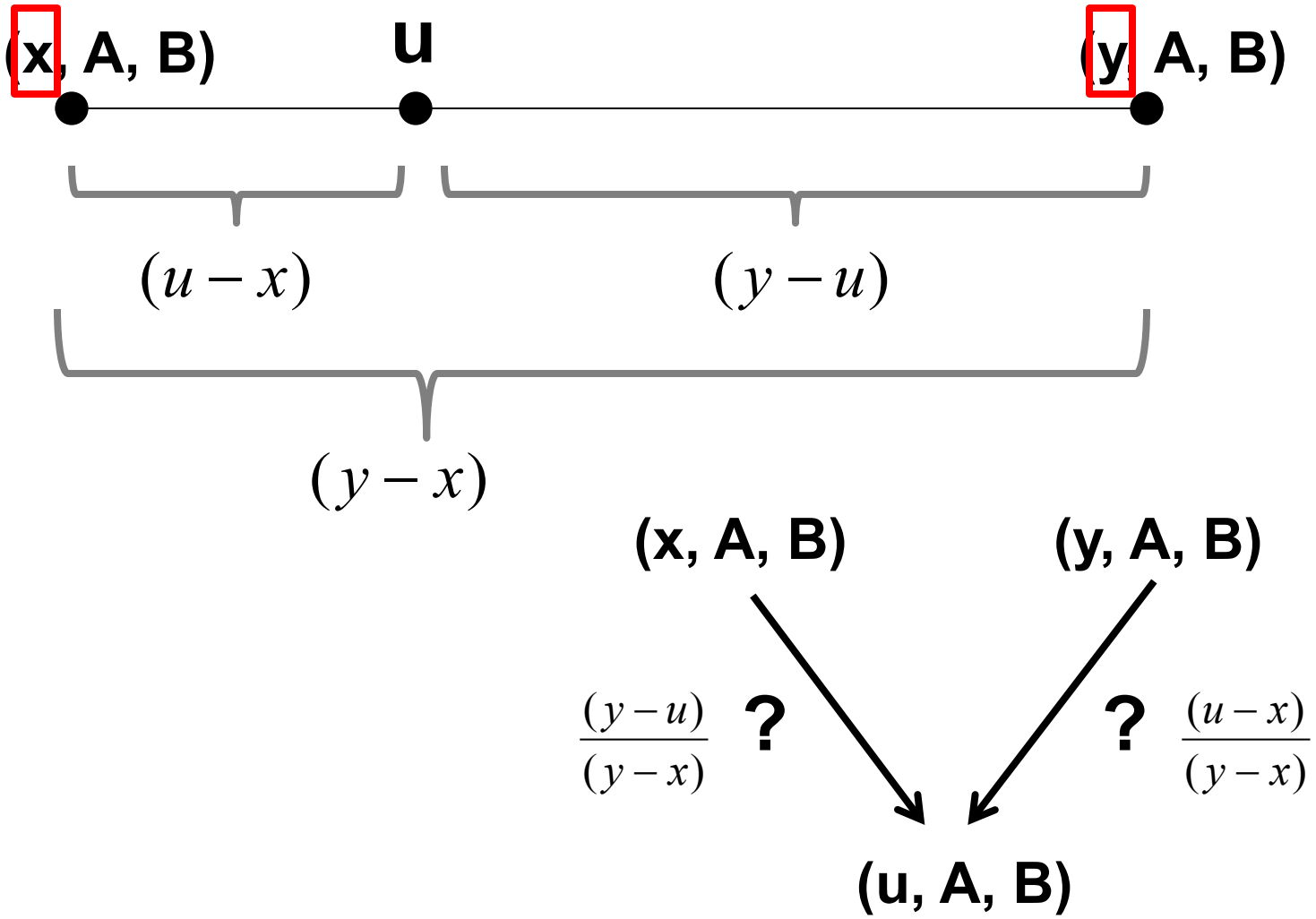
de Casteljau weights(how?) in B-Spline



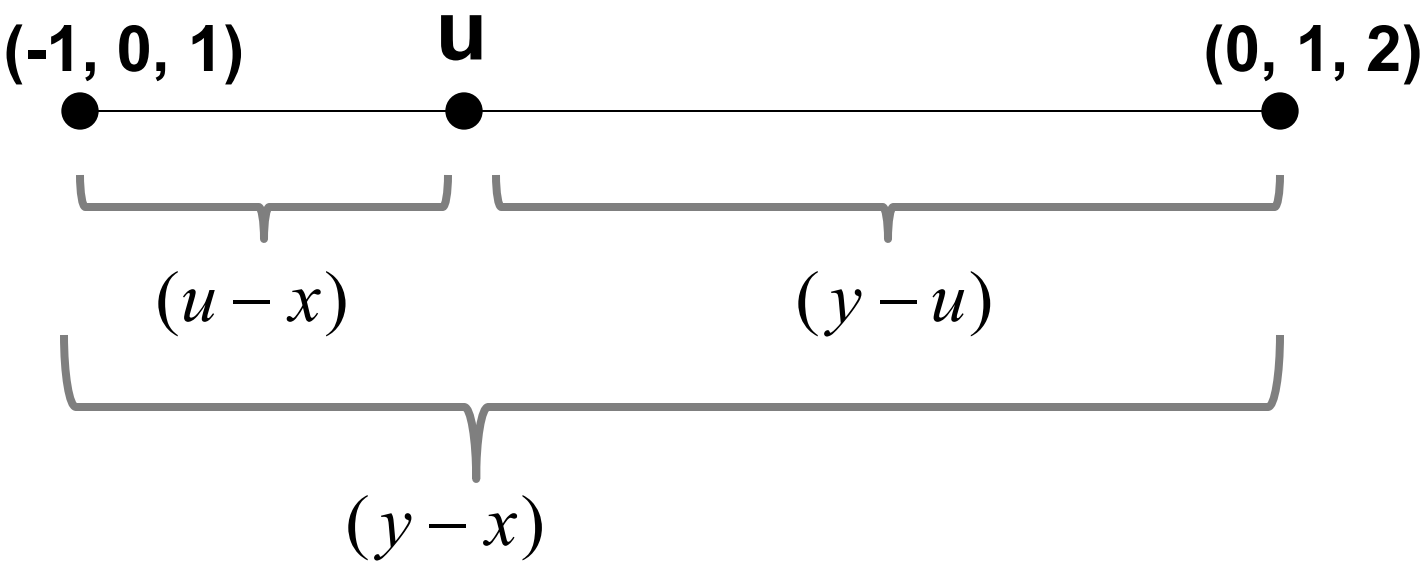
Interpolating Weights for BspIne

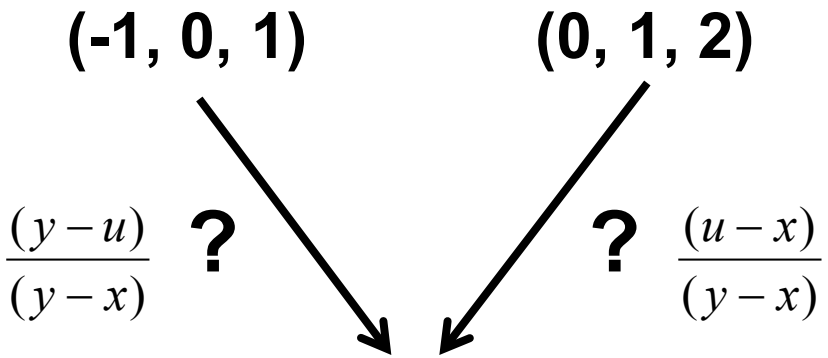


Interpolating Weights for BspIne

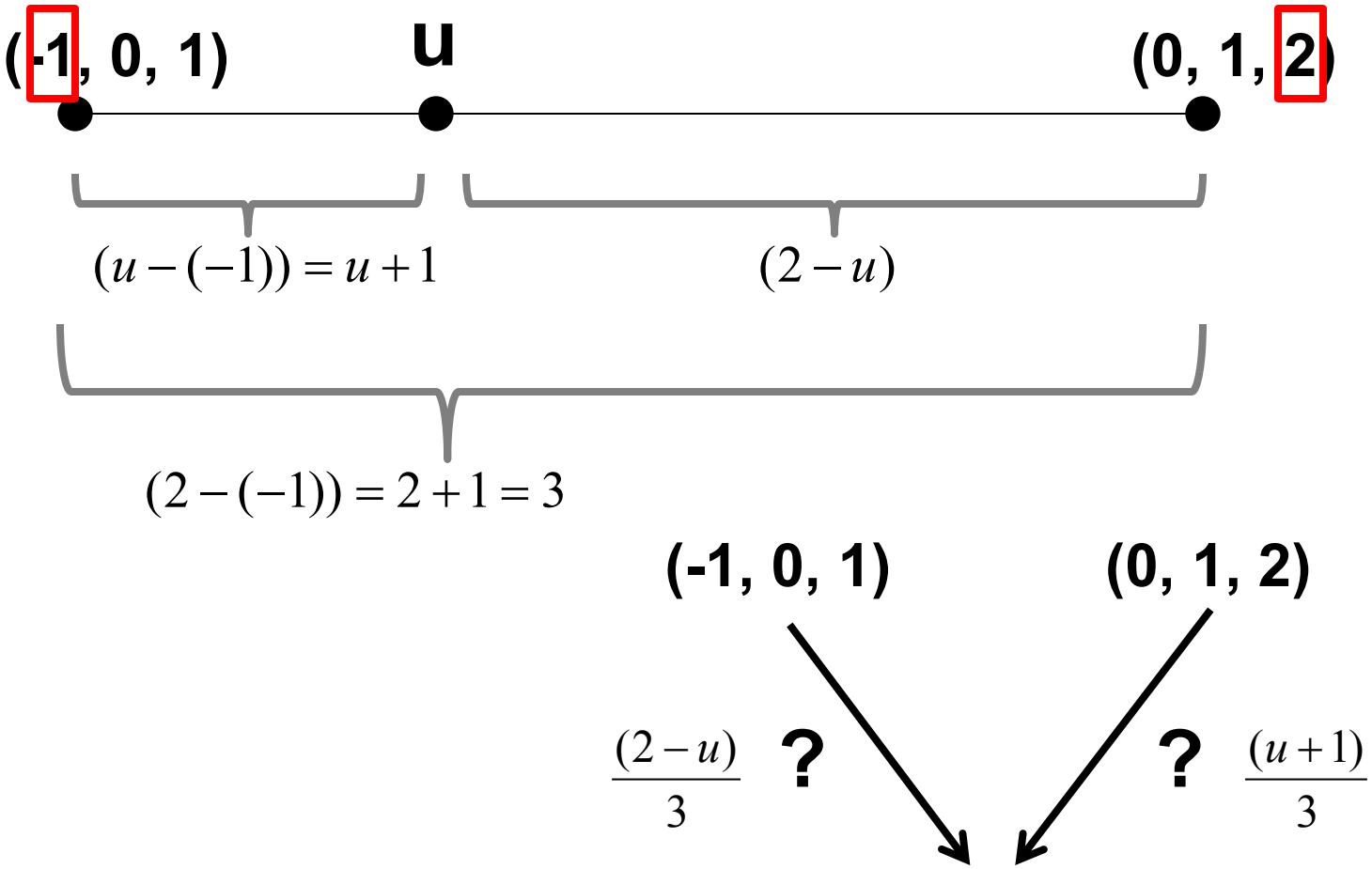


Example

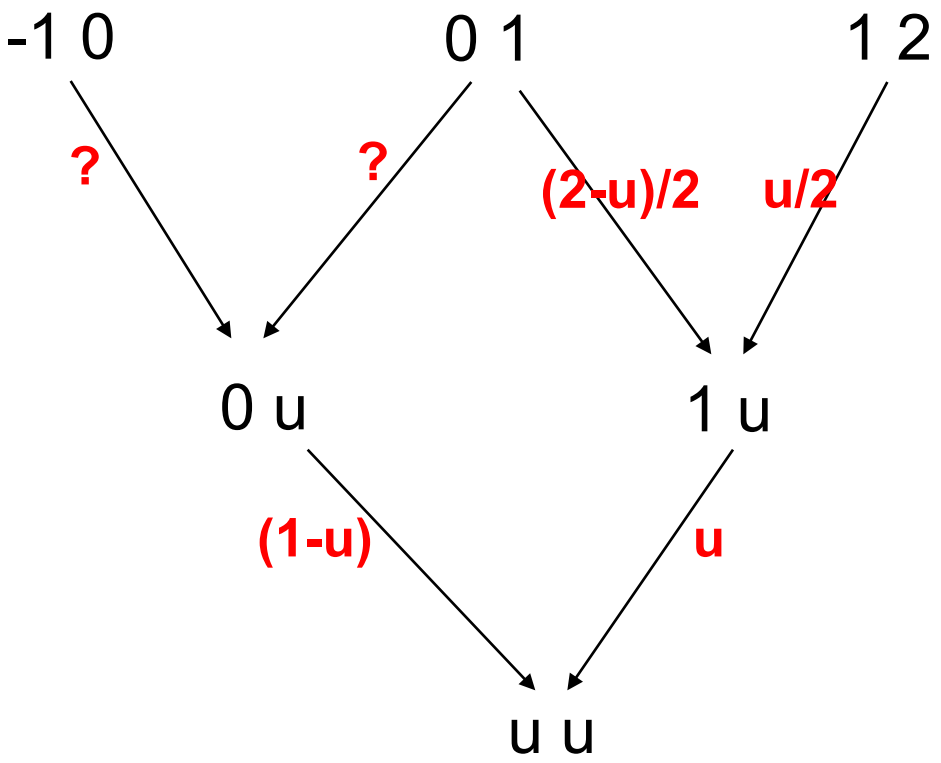




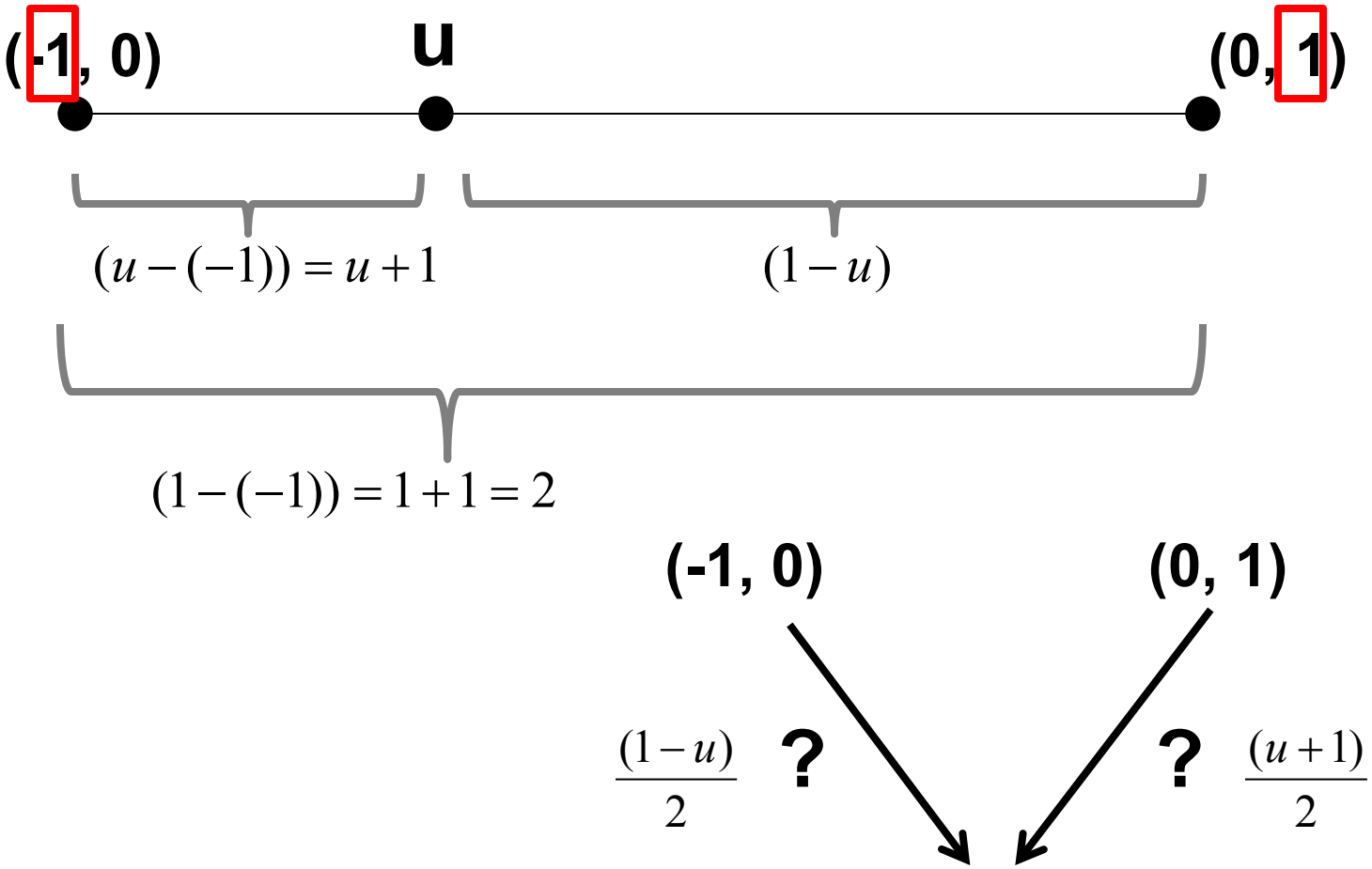
Example



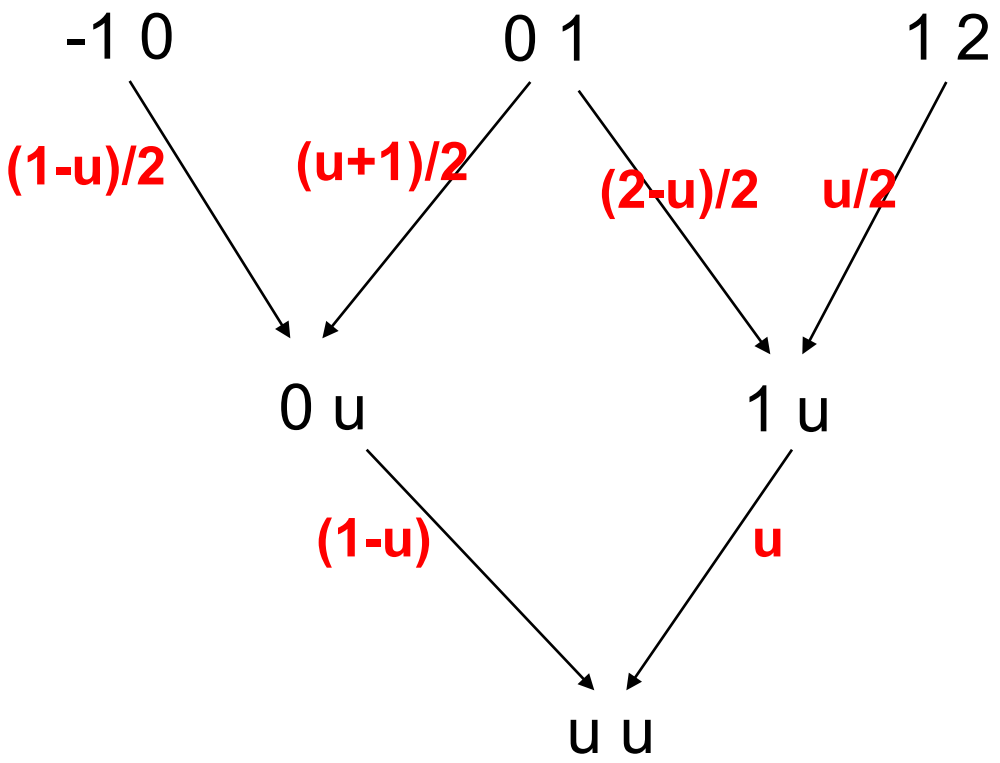
Weights for quadratic B-Spline



Example



Weights for quadratic B-Spline

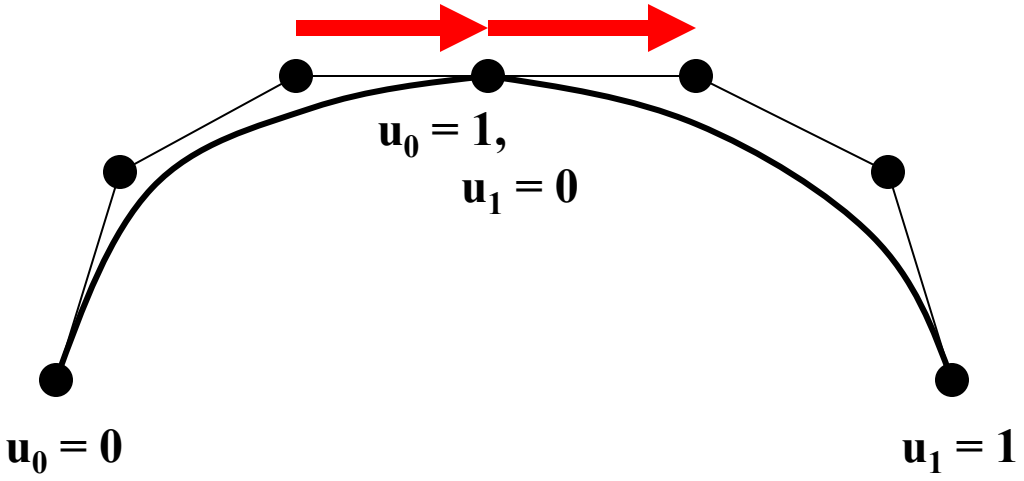


So why B-Spline and how?

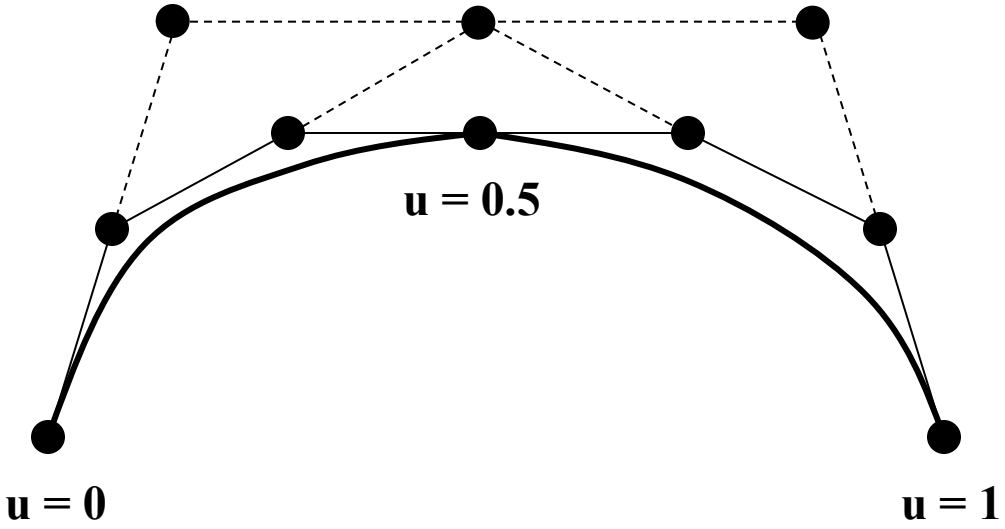
- Smoothness by joining Bezier curves
  - 3 points must be in the same line
  - Exact spacing
  - Hard to control

- Labeling
  - How to get the non-symmetric labeling
  - Knot-vector

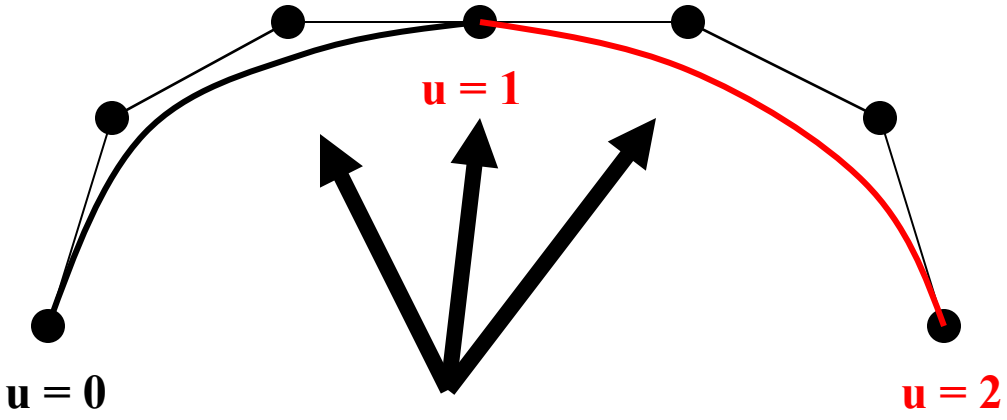
Connecting Bezier Curves



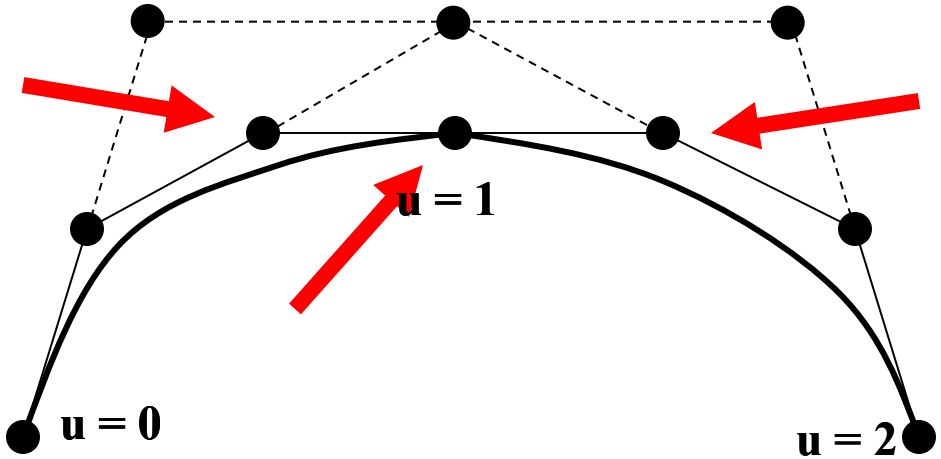
Remember Bezier Subdivision



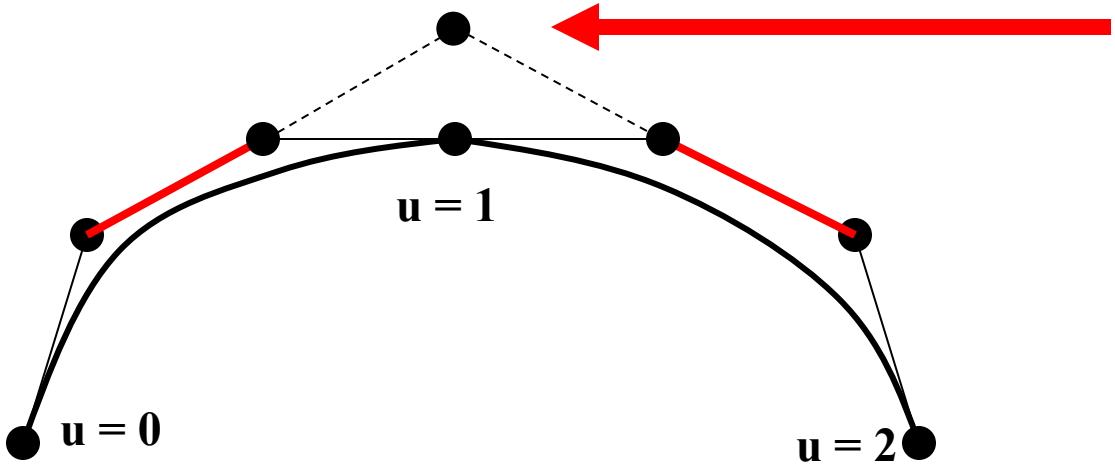
Uniform re-parameterization But Hard to Control !!!



Need to control all 3 simultaneously

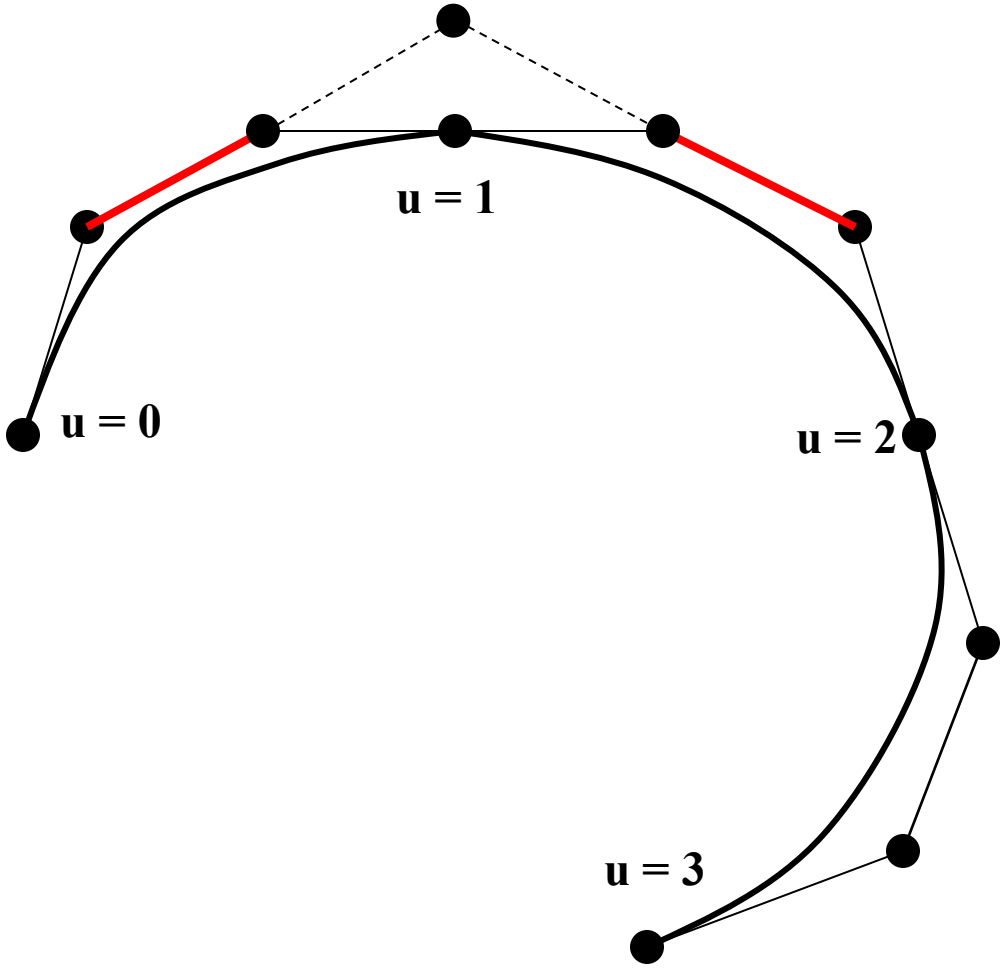


Controllability

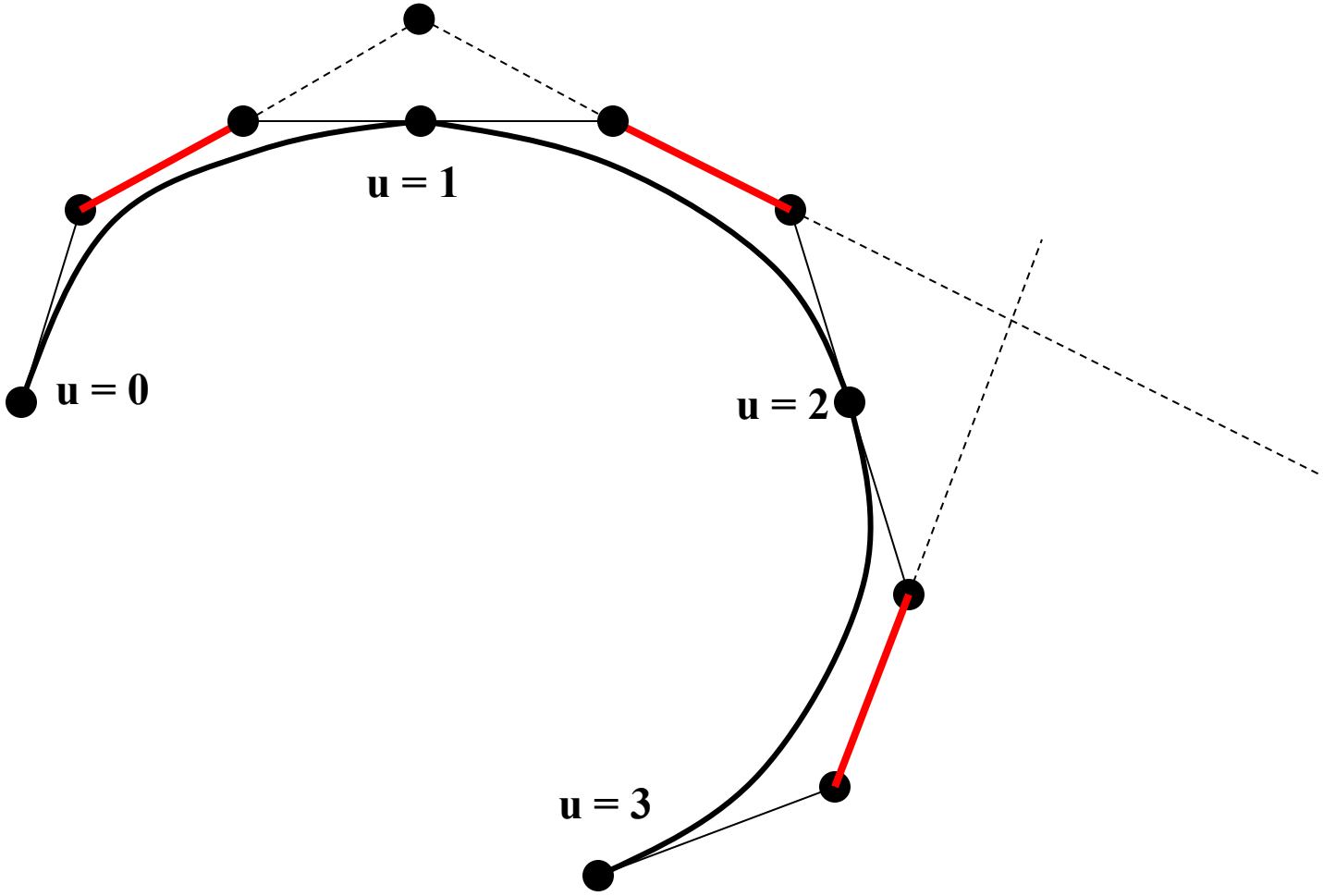


And…you can skip the derivation if you want

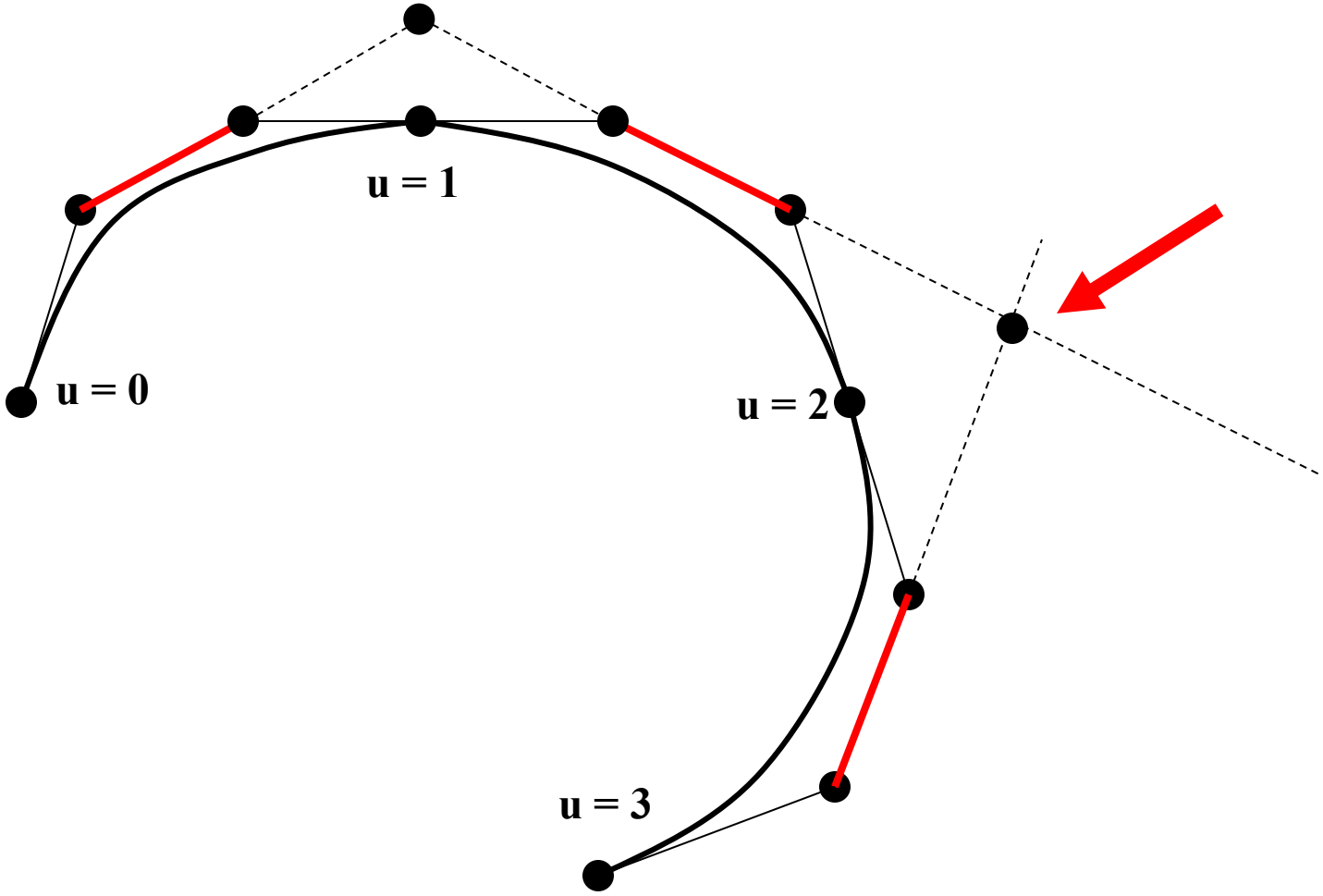
Adding the 3rd Segment



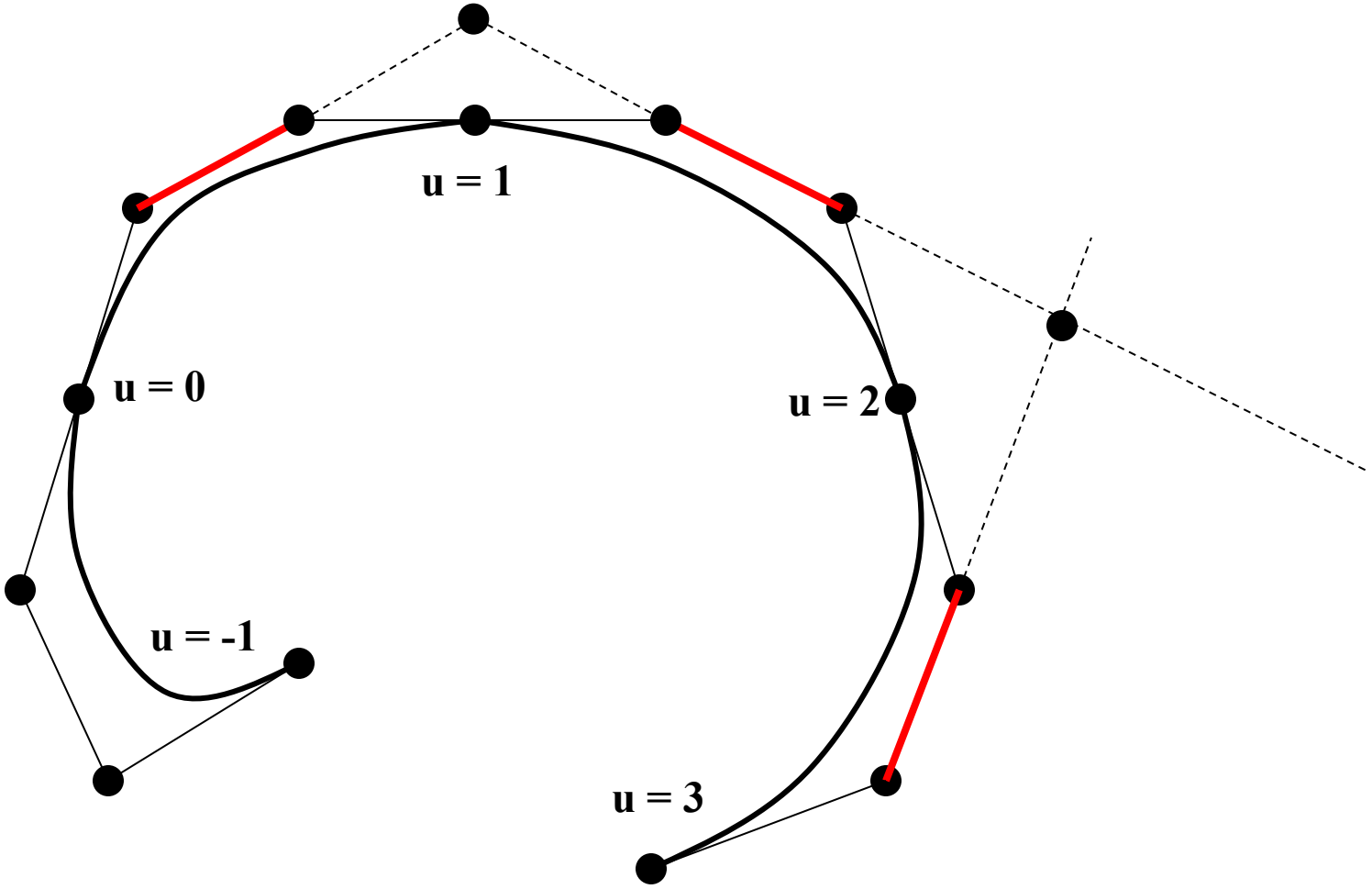
Reverse Subdivision



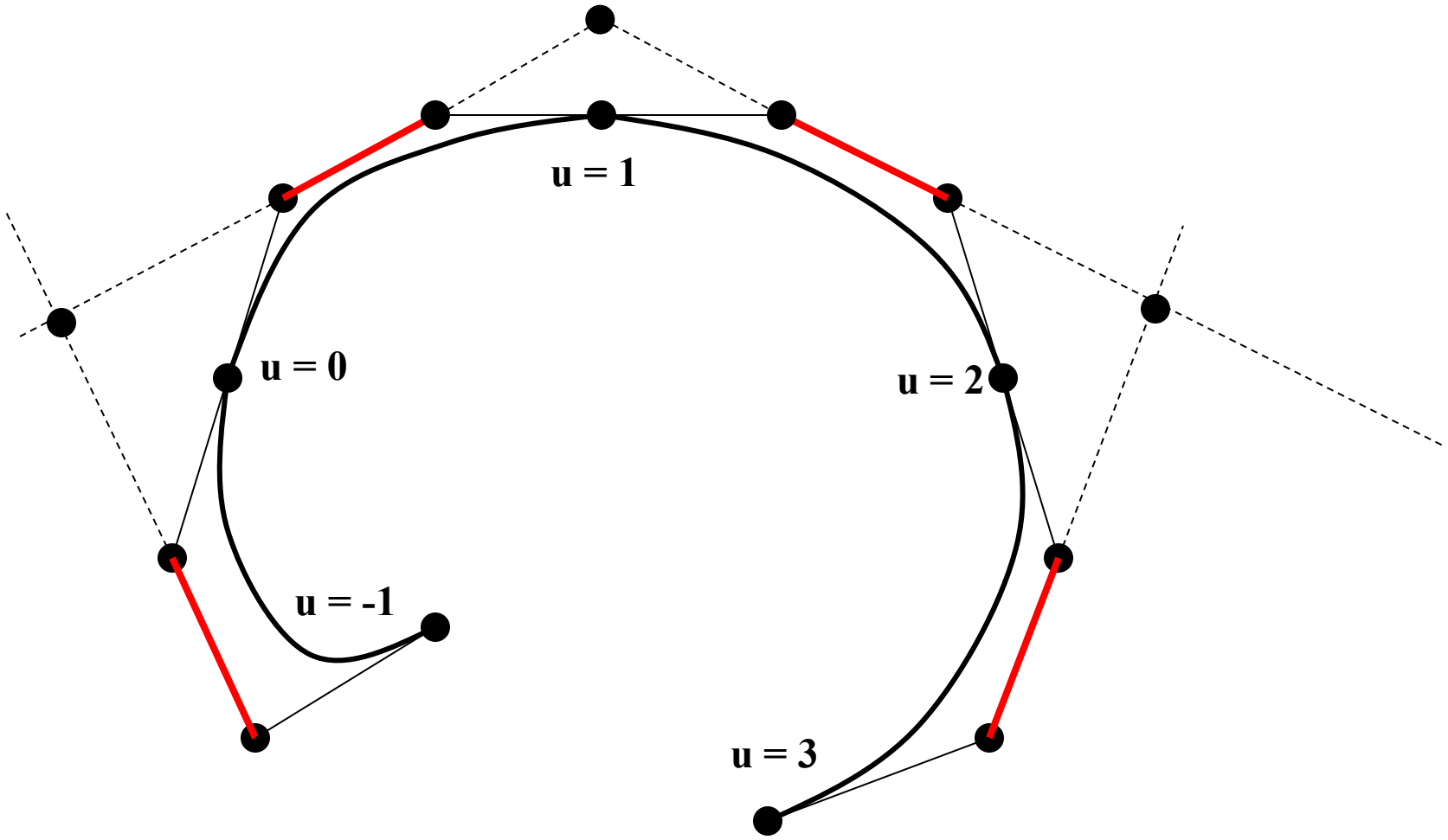
Adding New Control



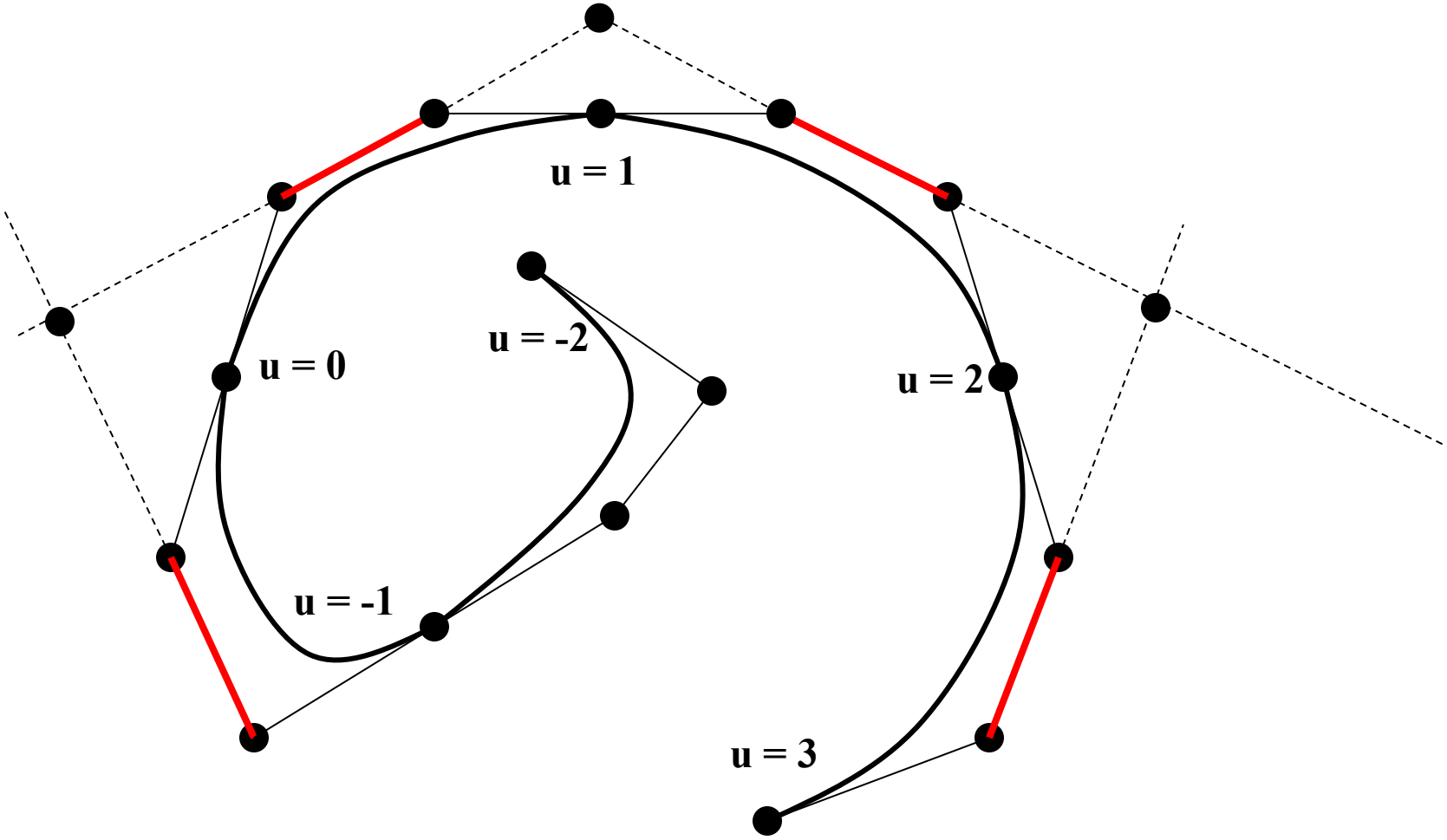
Prepend Segments u=-1~0



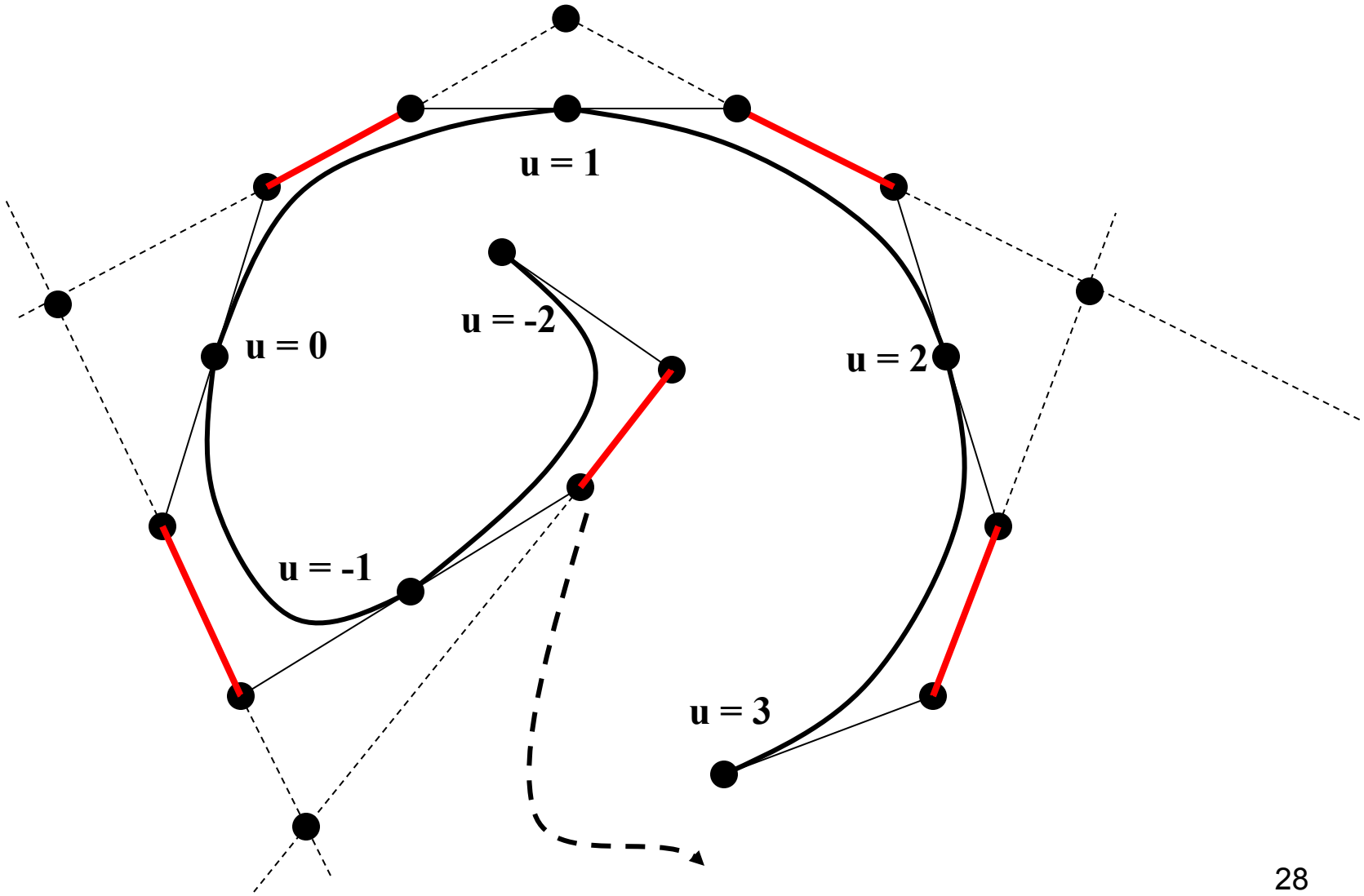
Add the New Control



Prepend new Segment u = -2~-1



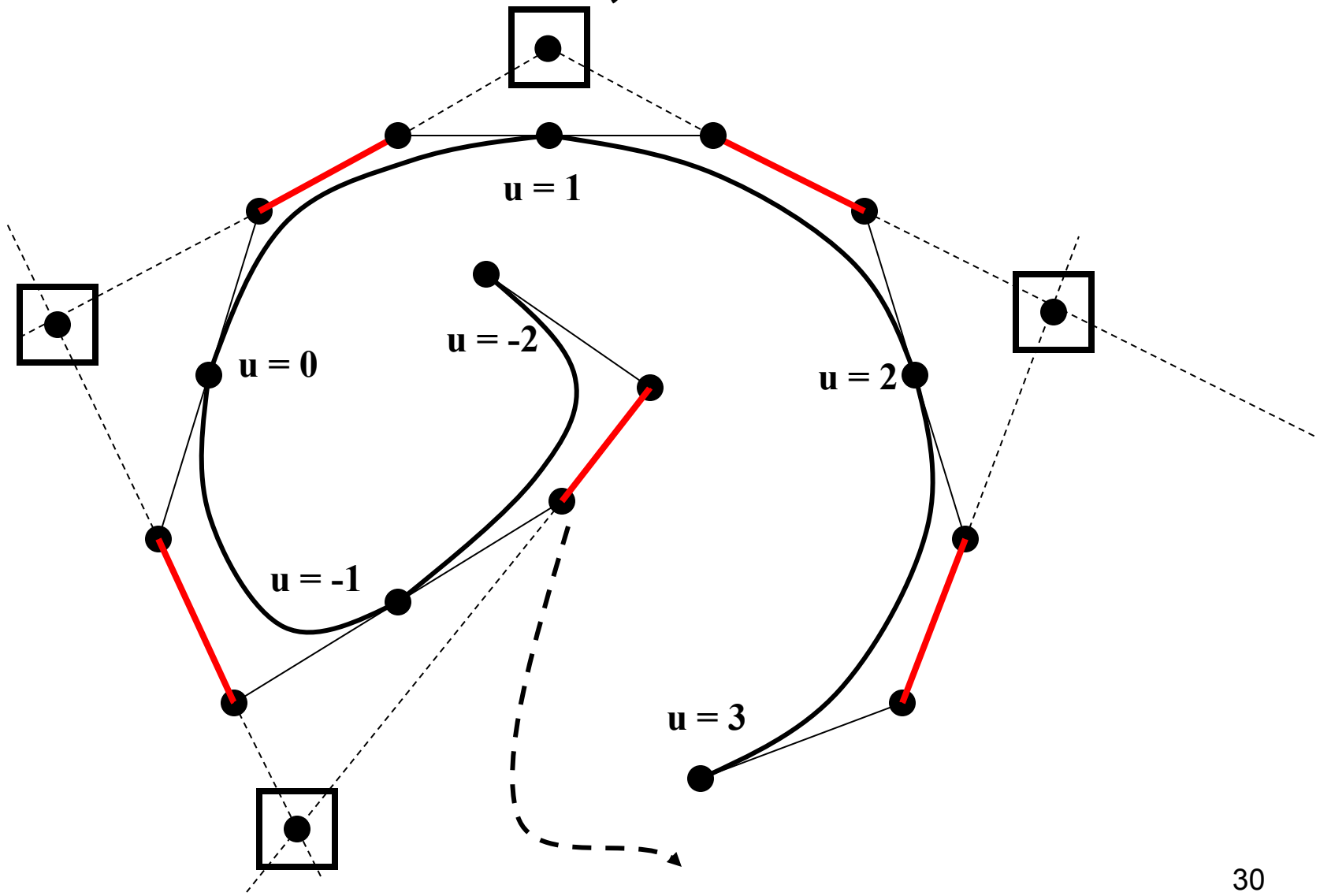
Add new control



Should be mid point, sorry for bad drawing

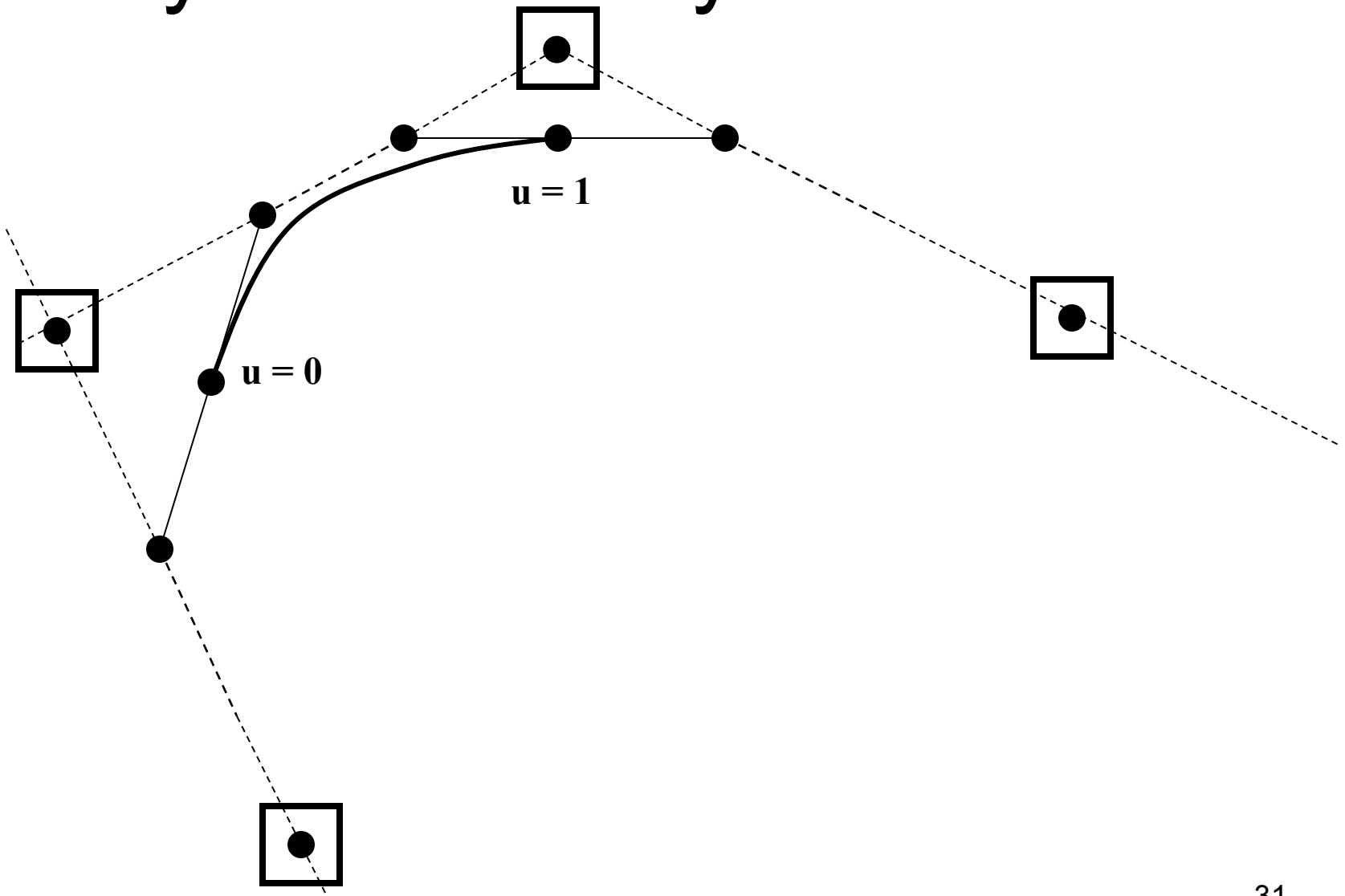
OK, stop, wake up

Here's the "BOX," Control Points

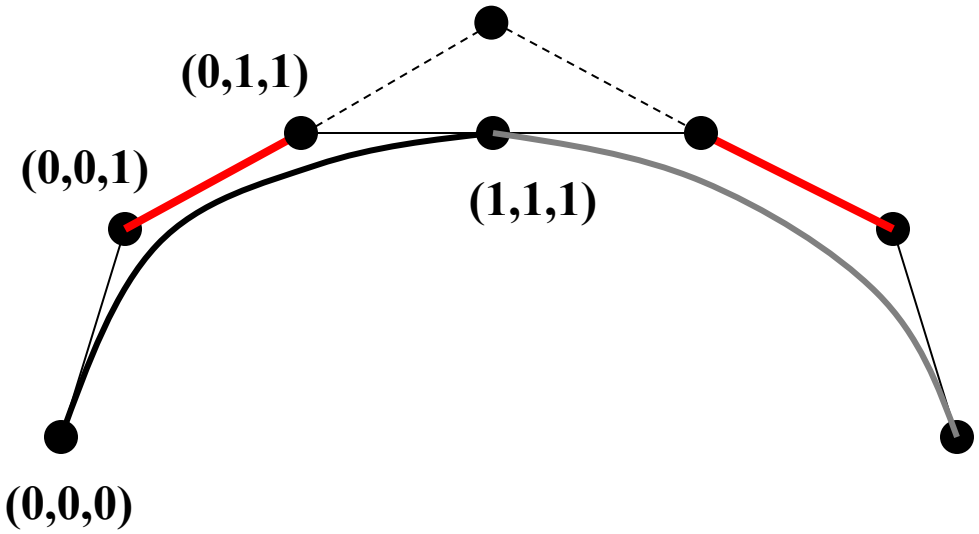


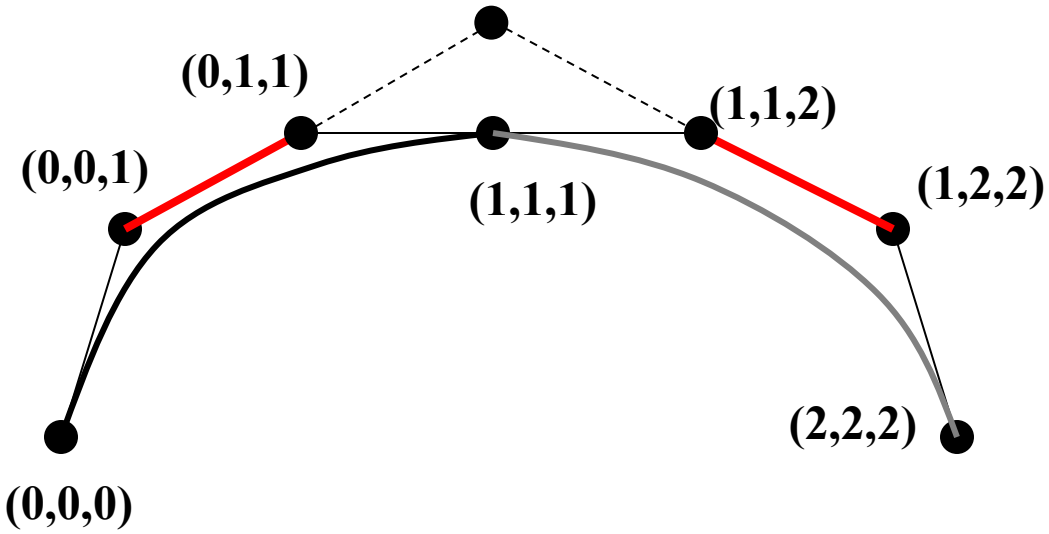
Should be mid point, sorry for bad drawing

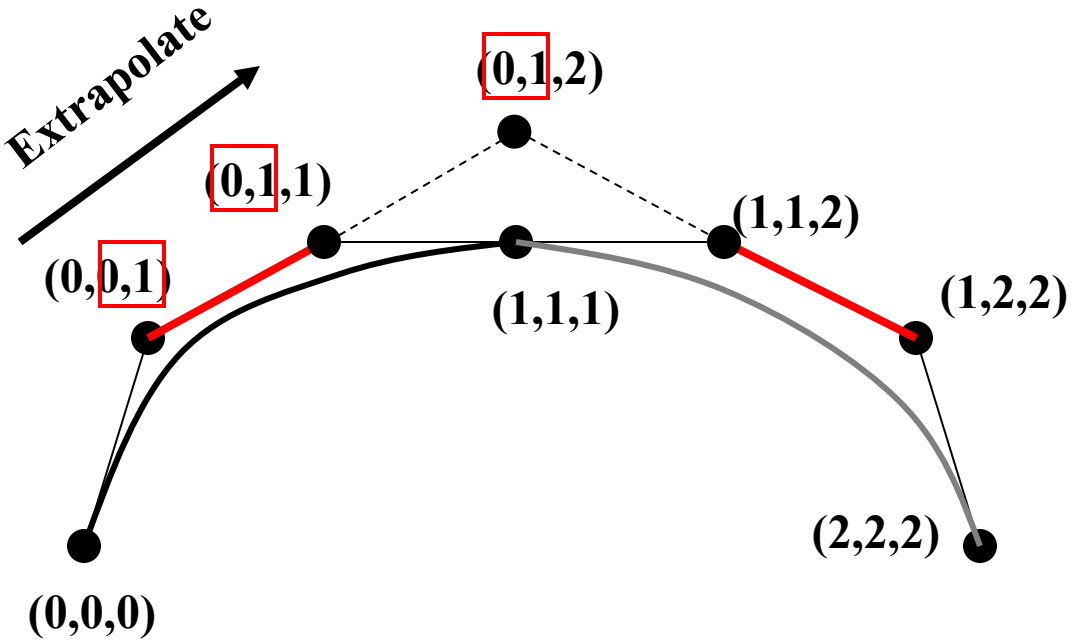
If you want only u = 0 ~ 1

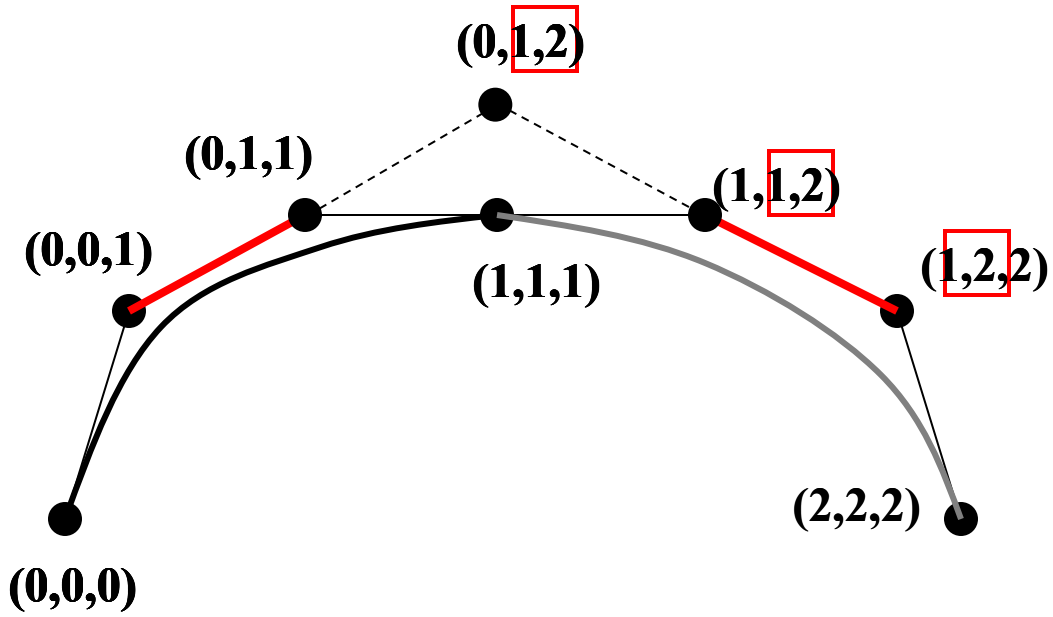


Labeling from 2 Bezier curves

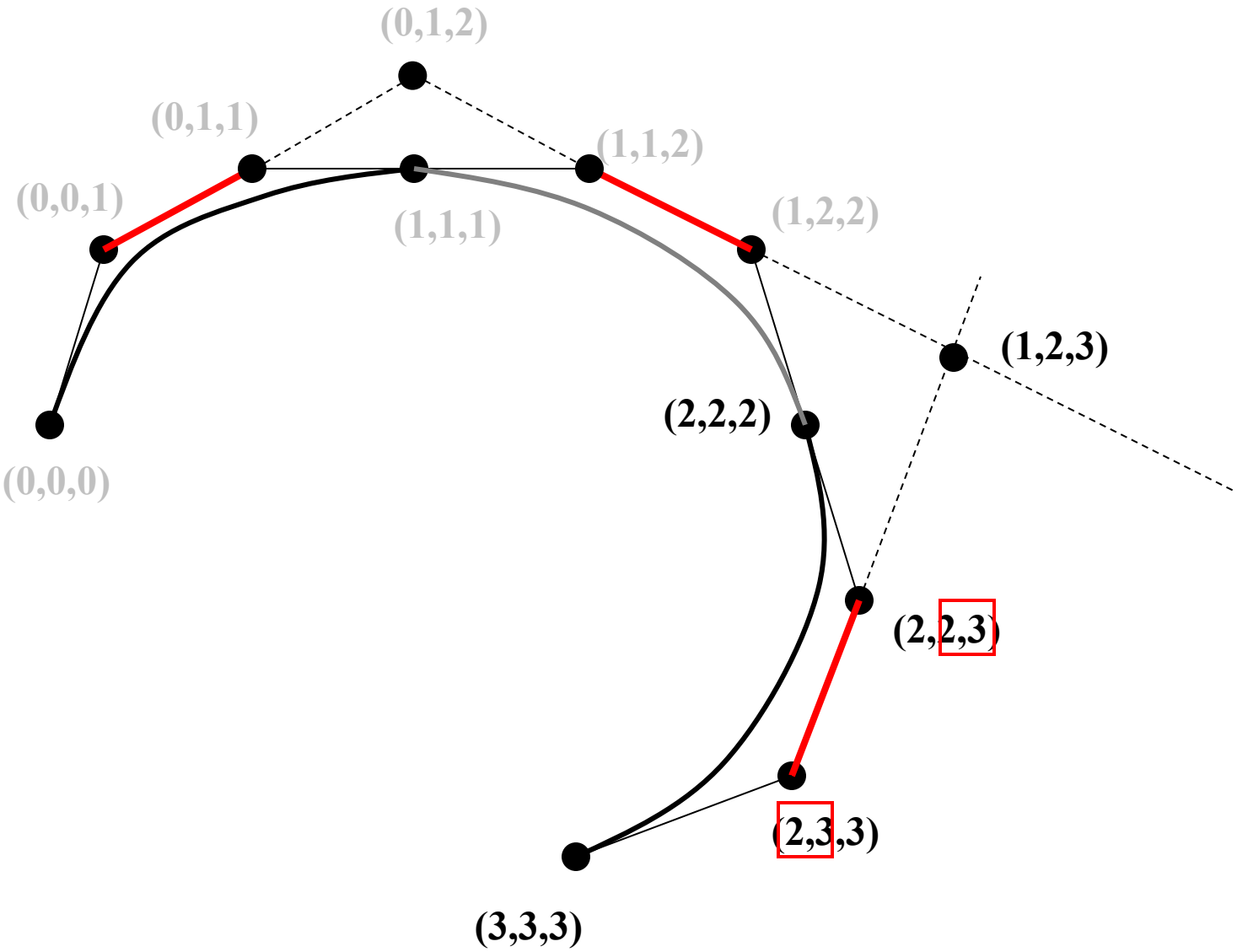


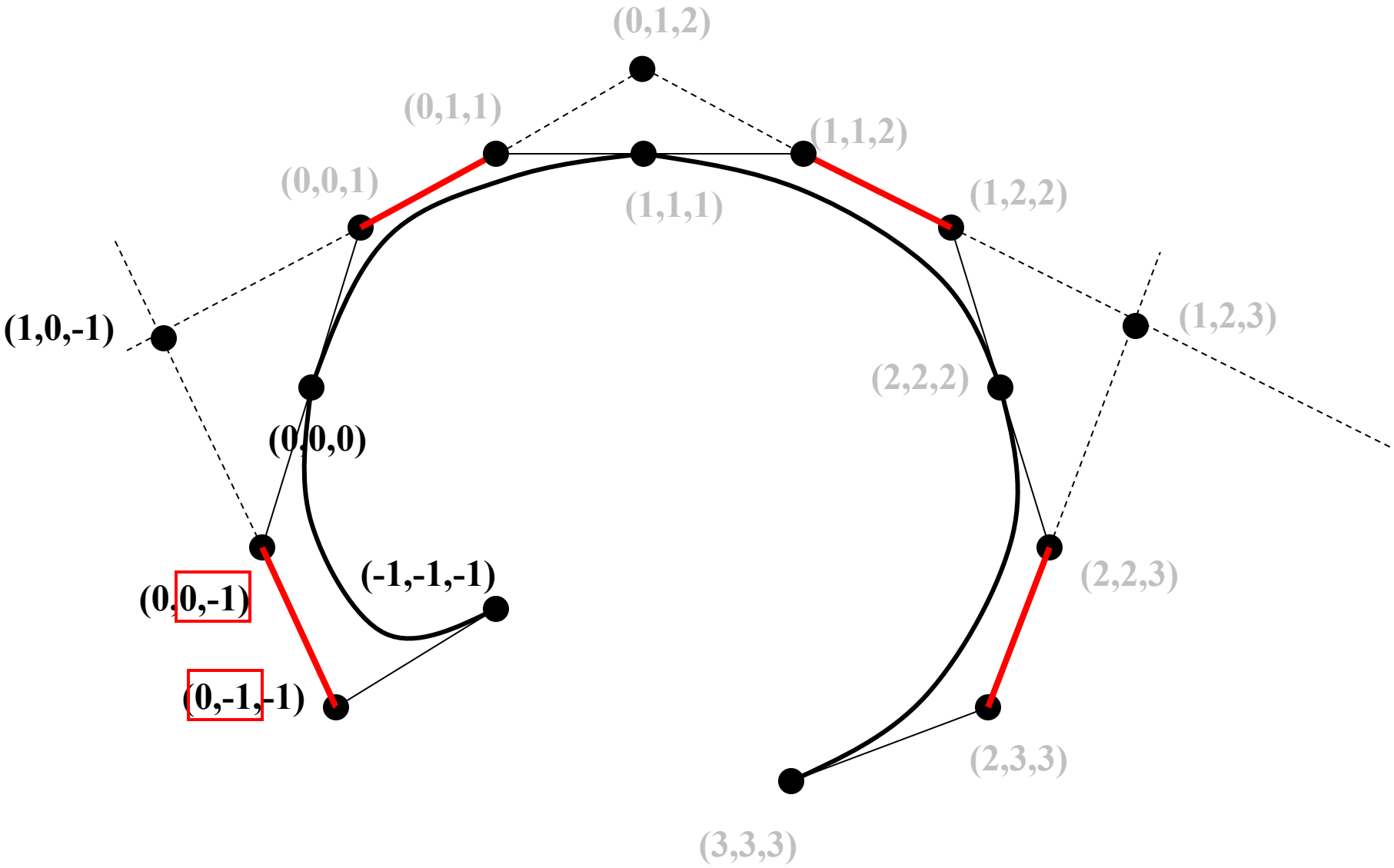

(0,1,1)
(1,1,2)
(0,0,1)
(1,1,1)
(1,2,2)
(2,2,2)
(0,0,0)

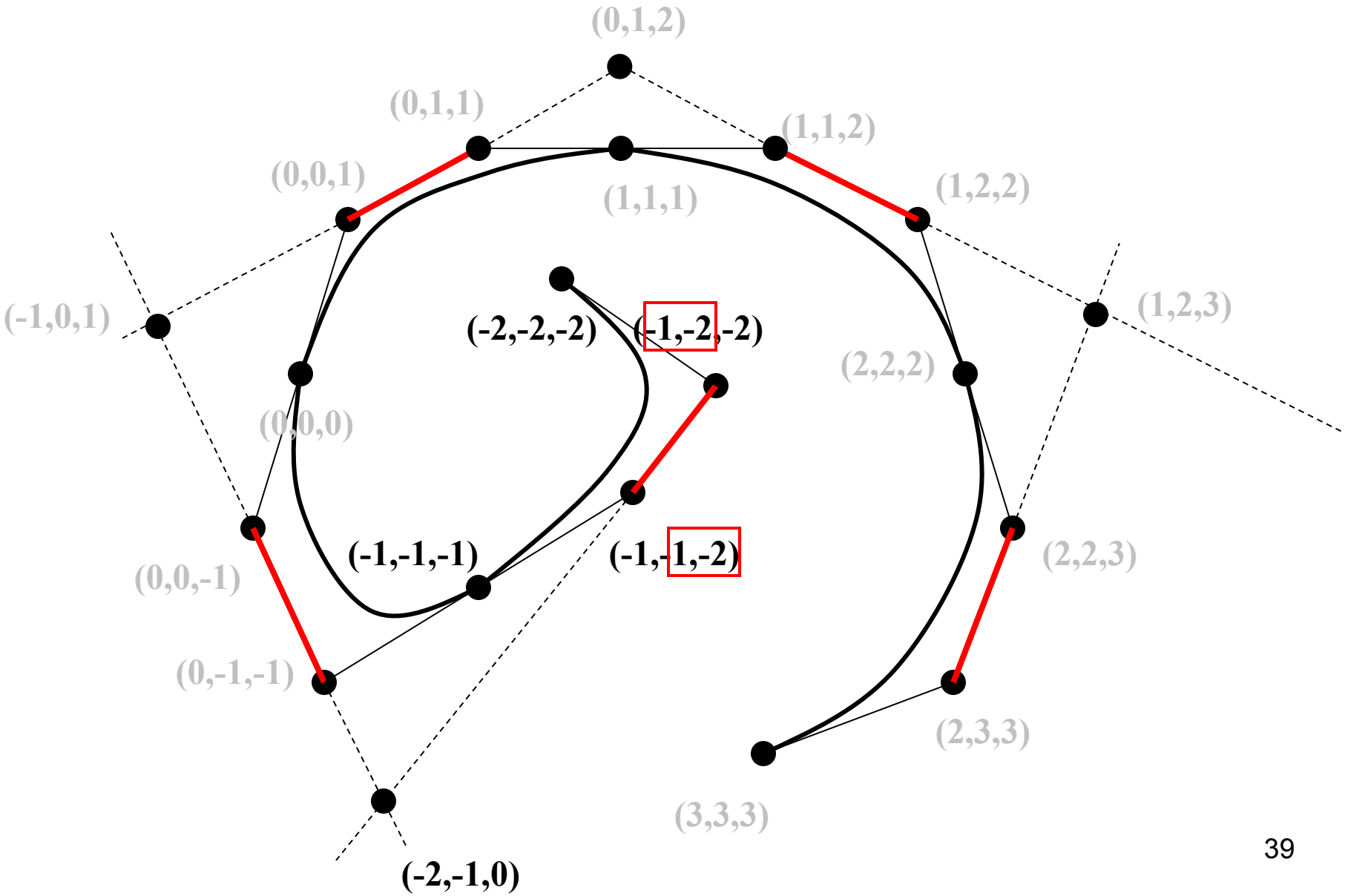

Extrapolate
(0,1,2)
(0,1,1)
(1,1,2)
(0,0,1)
(1,2,2)
(1,1,1)
(2,2,2)
(0,0,0)


(0,1,2)
(0,1,1)
(1,1,2)
(0,0,1)
(1,1,1)
(1,2,2)
(2,2,2)
(0,0,0)

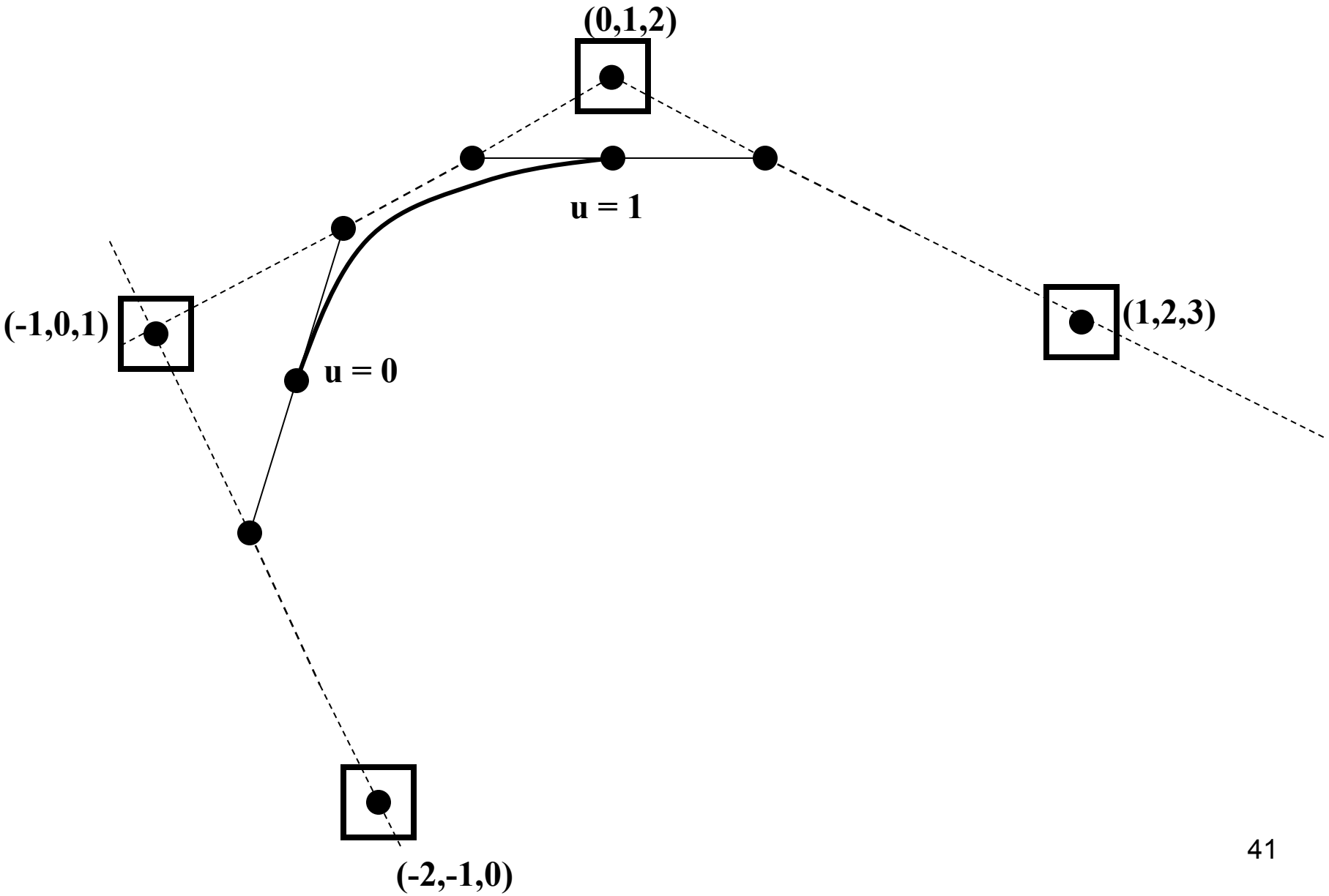
Now you can skip derivation for all labeling…


(0,1,2)
(0,1,1)
(1,1,2)
(0,0,1)
(1,1,1)
(1,2,2)
(1,2,3)
(2,2,2)
(0,0,0)
(2,2,3)
(2,3,3)
(3,3,3)


(0,1,2)
(0,1,1)
(1,1,2)
(0,0,1)
(1,1,1)
(1,2,2)
(1,0,-1)
(1,2,3)
(2,2,2)
(0,0,0)
(-1,-1,-1)
(2,2,3)
(0,0,-1)
(0,-1,-1)
(2,3,3)
(3,3,3)


(0,1,2)
(0,1,1)
(1,1,2)
(0,0,1)
(1,1,1)
(1,2,2)
(-1,0,1)
(1,2,3)
(-2,-2,-2)
(-1,-2,-2)
(2,2,2)
(0,0,0)
(-1,-1,-1)
(-1,-1,-2)
(0,0,-1)
(2,2,3)
(0,-1,-1)
(2,3,3)
(3,3,3)
(-2,-1,0)

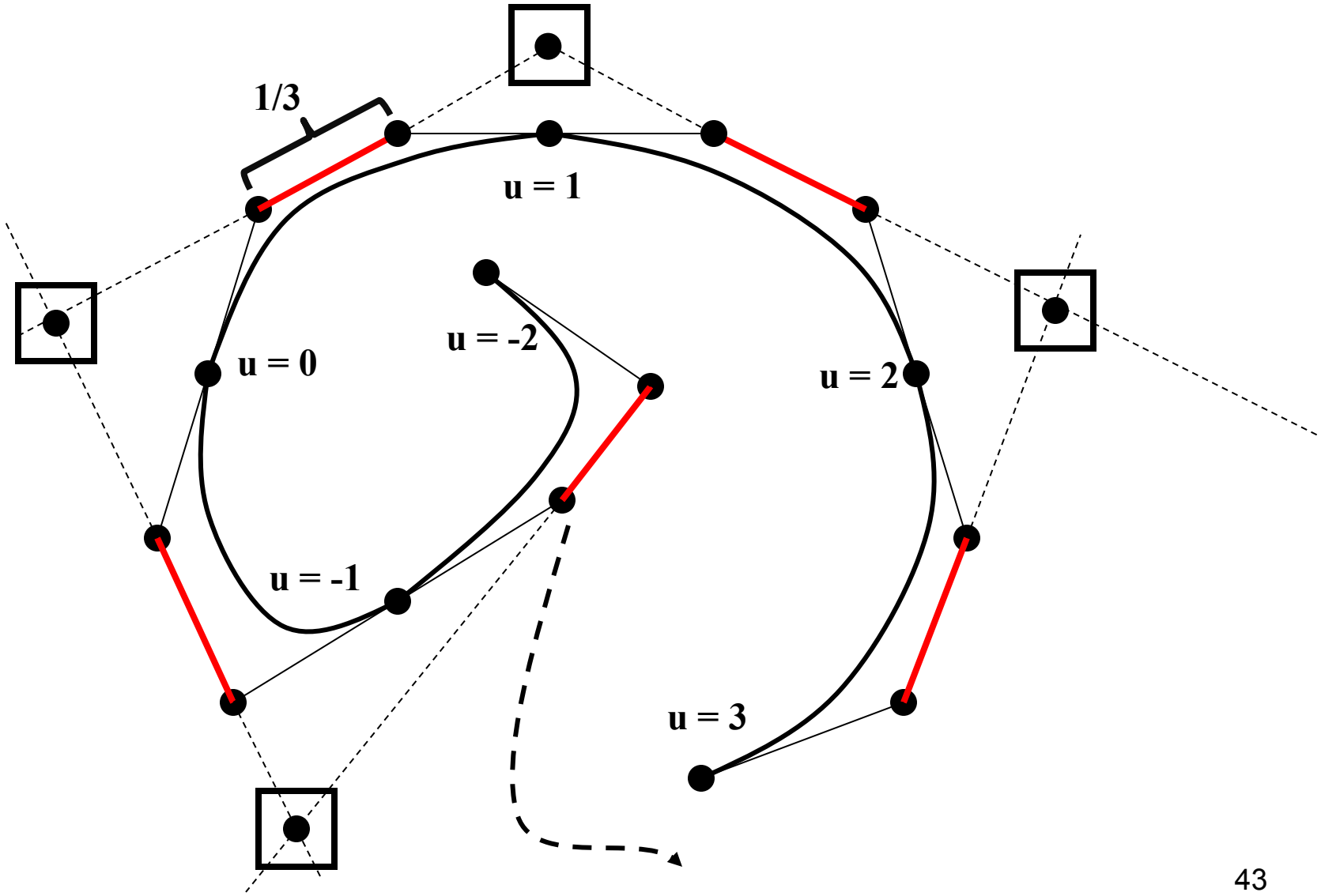
OK, we're done.
Here's the final labeling


(0,1,2)
u = 1
(-1,0,1)
u = 0
(1,2,3)
(-2,-1,0)

Extensions

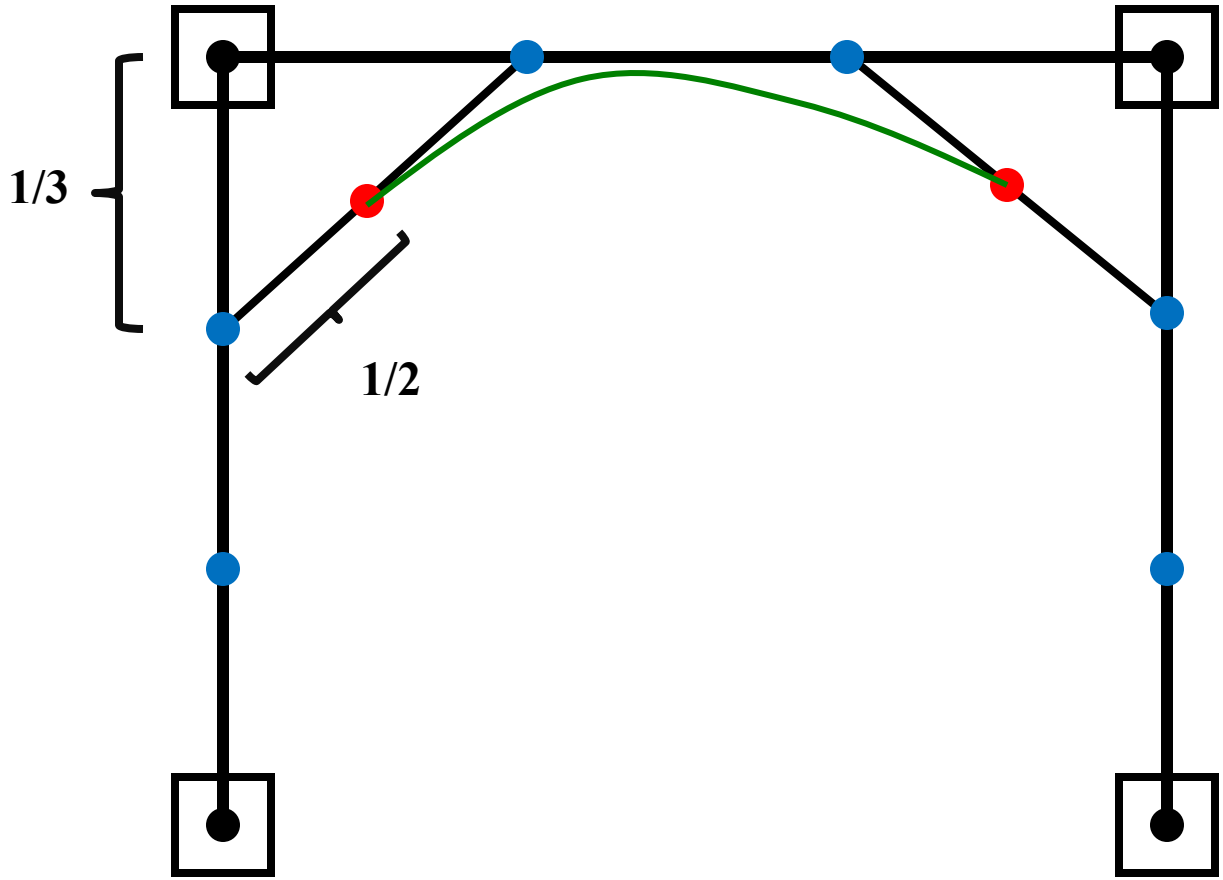
- B-Spline to Bezier
- Bezier to B-Spline

If you stare at the graph for a long time…

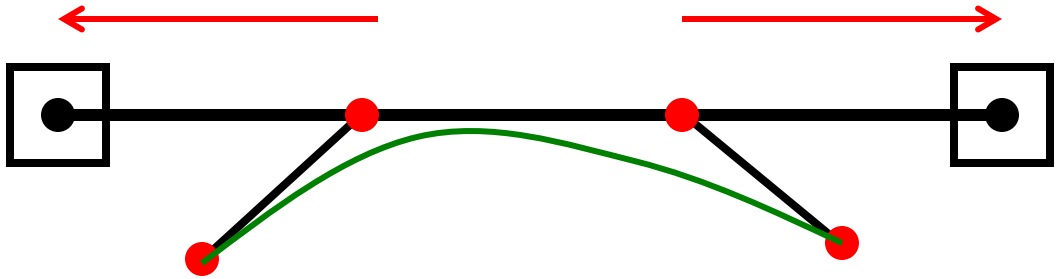


Should be mid point, sorry for bad drawing

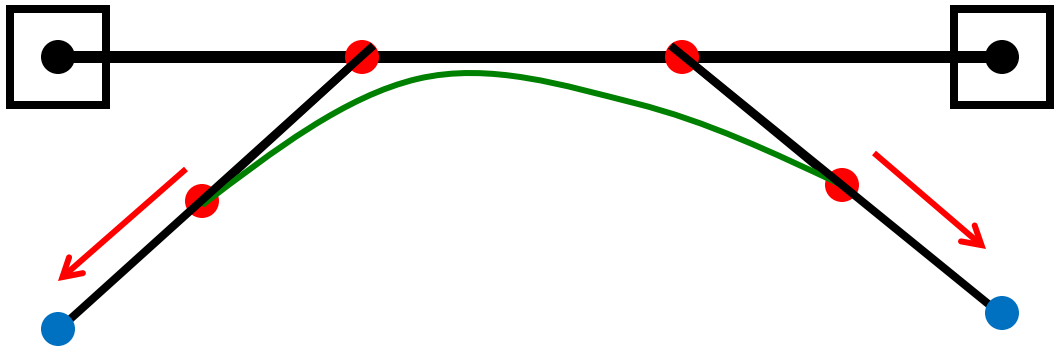
Easy conversion from B-Spline and Bezier



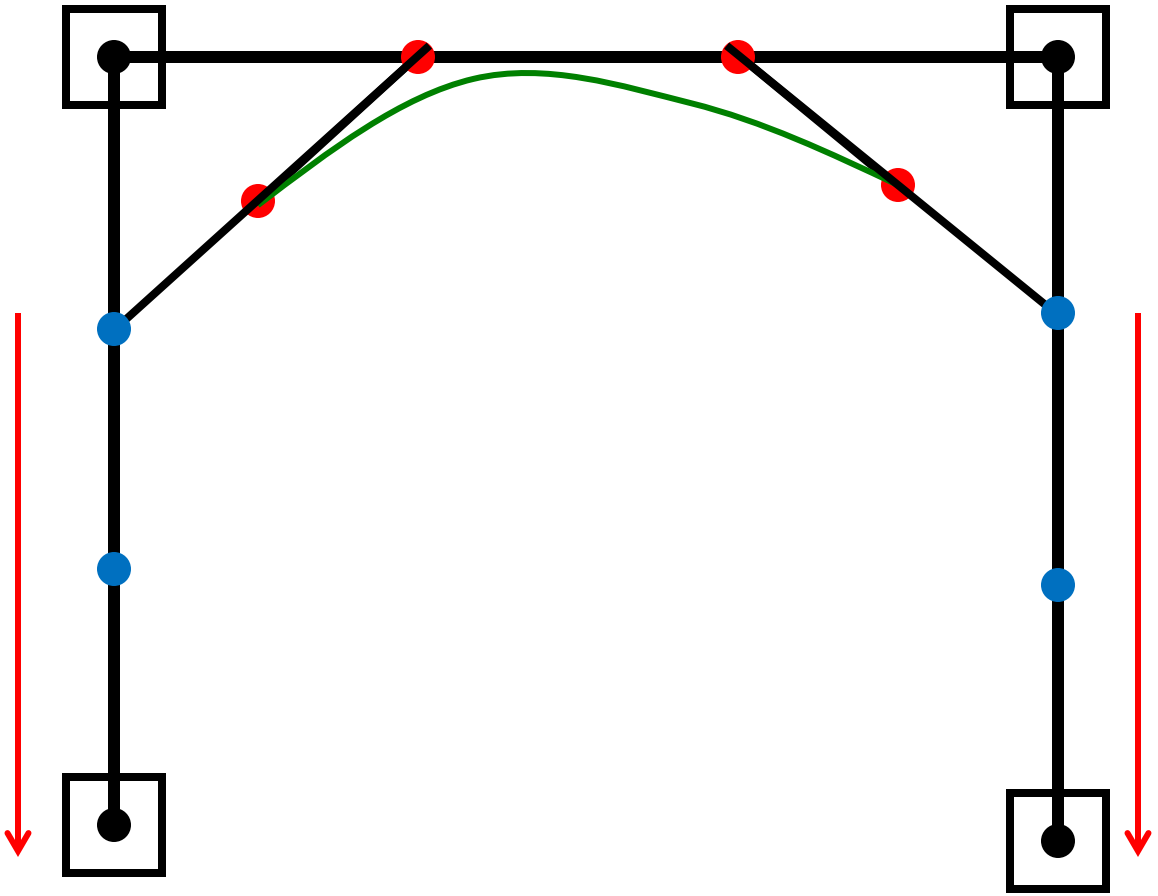
Bezier to Bspline



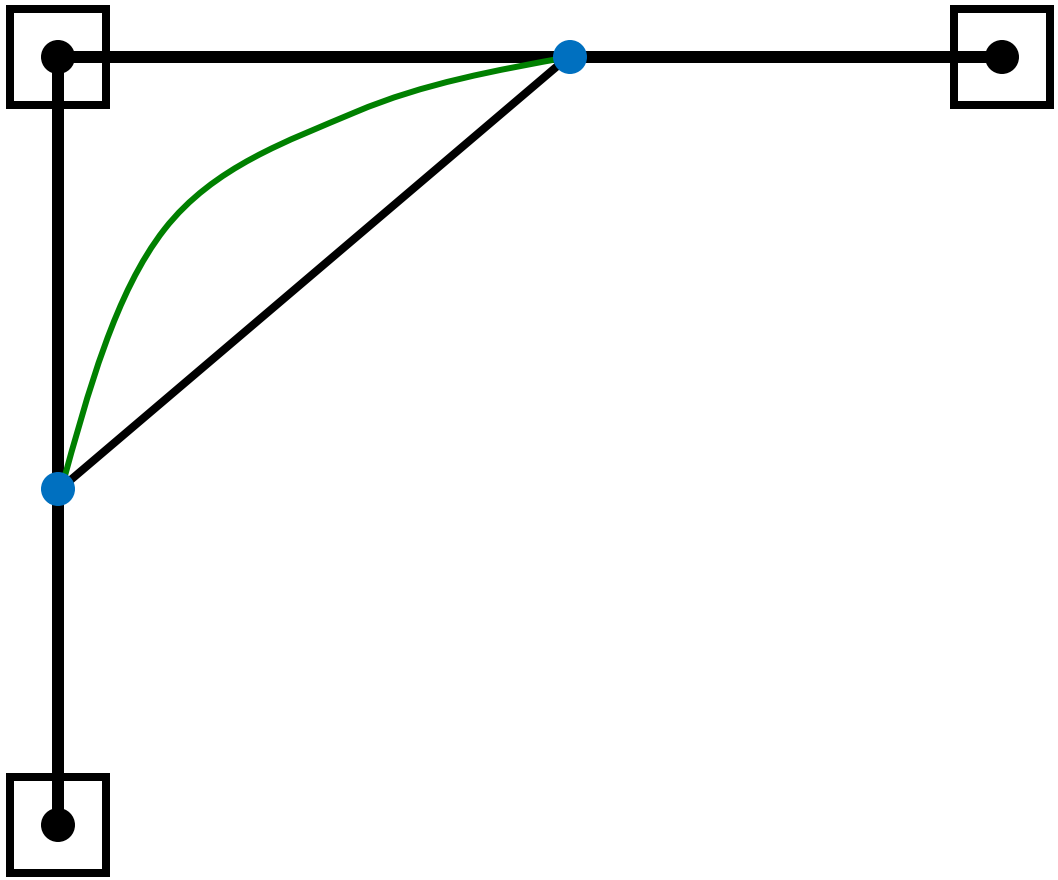
Bezier to Bspline



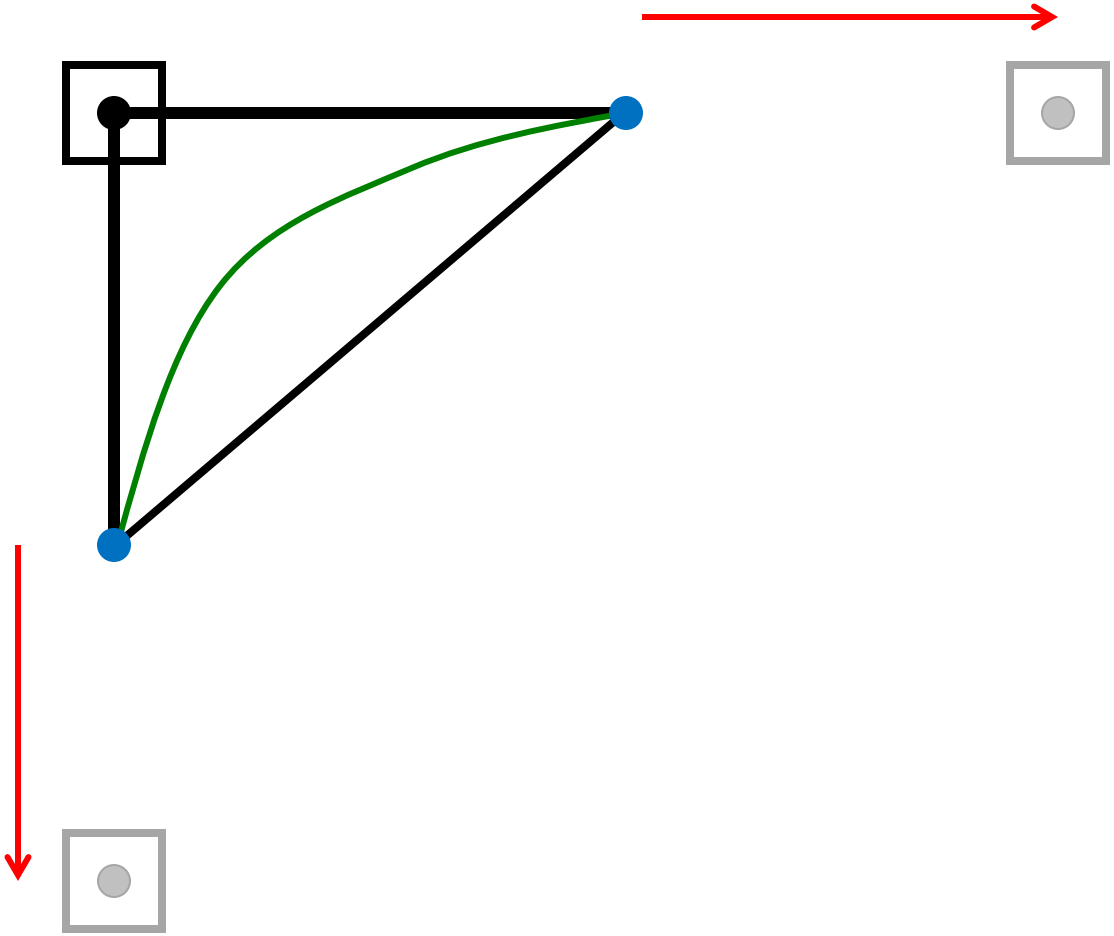
Bezier to Bspline



Easy conversion from B-Spline and Bezier



Bezier to B-Spline



Bezier to B-Spline