B-Spline Blossoms

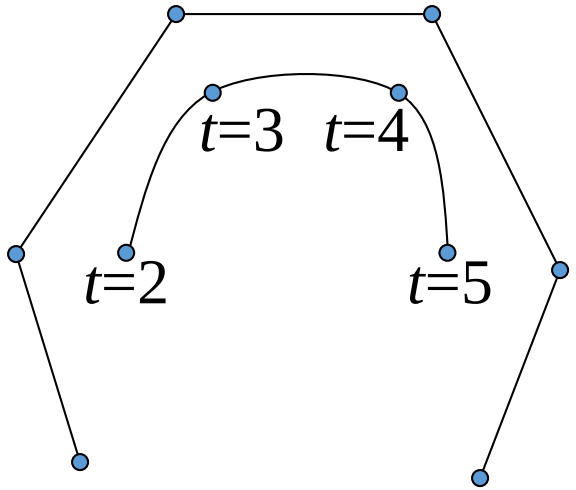
CS 418

Interactive Computer Graphics

John C. Hart

The Blossoming Game

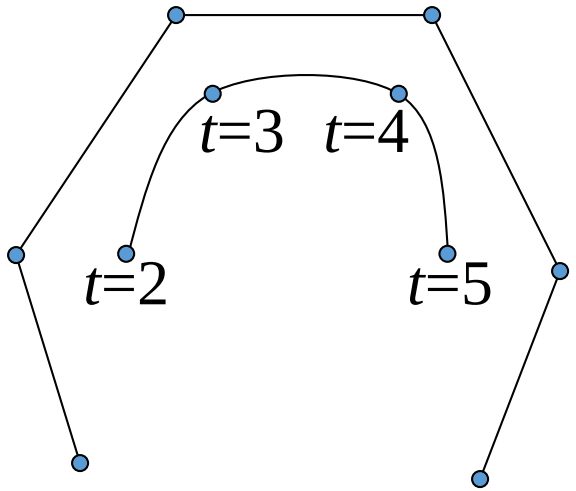
B-Spline Rules for Setting Up the Board



The Blossoming Game

B-Spline Rules for Setting Up the Board

1. Create a knot vector
   (with two extra values at each end)

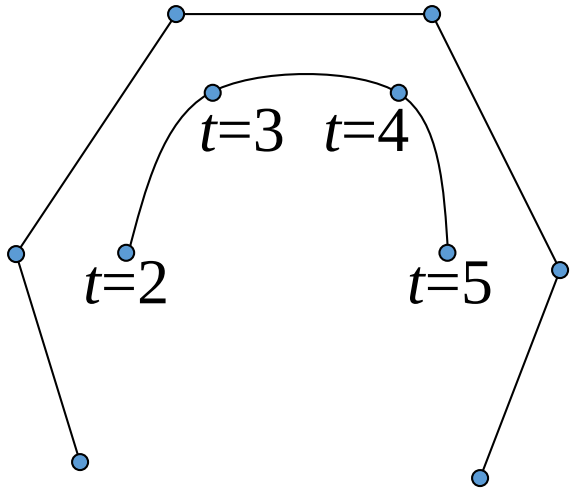


knot vector: [0 1 2 3 4 5 6 7]

The Blossoming Game

B-Spline Rules for Setting Up the Board

1. Create a knot vector
   (with two extra values at each end)
2. Label each control vertex
   with triples of knots

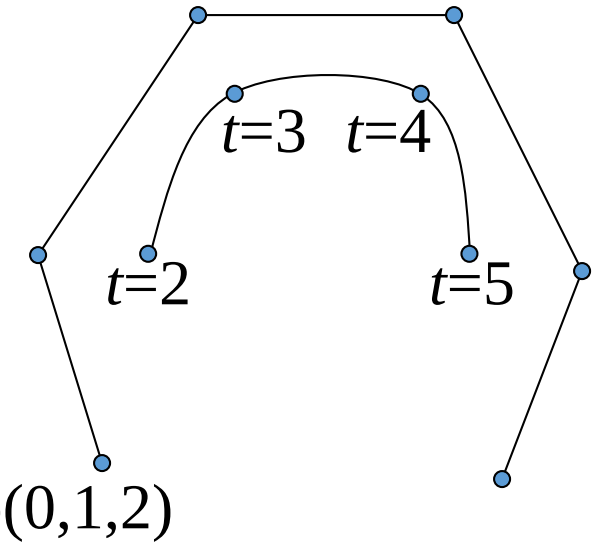


knot vector: [0 1 2 3 4 5 6 7]

The Blossoming Game

B-Spline Rules for Setting Up the Board

1. Create a knot vector
   (with two extra values at each end)
2. Label each control vertex
   with triples of knots

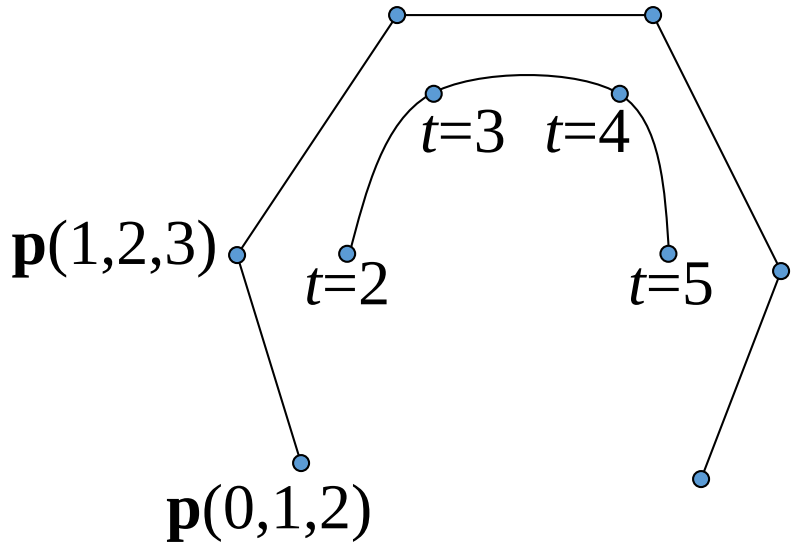


knot vector: [**0 1 2** 3 4 5 6 7]

The Blossoming Game

B-Spline Rules for Setting Up the Board

1. Create a knot vector
   (with two extra values at each end)
2. Label each control vertex
   with triples of knots

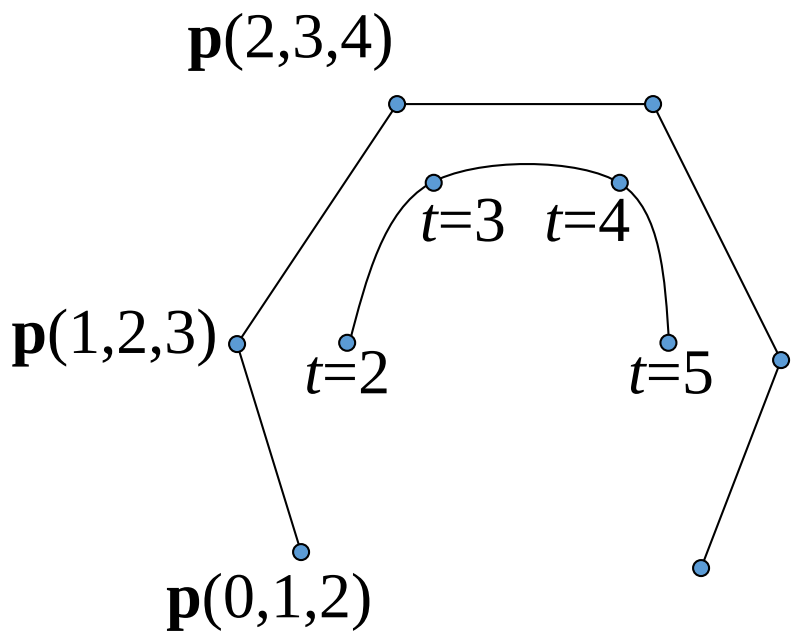


knot vector: [0 **1 2 3** 4 5 6 7]

The Blossoming Game

B-Spline Rules for Setting Up the Board

1. Create a knot vector
   (with two extra values at each end)
2. Label each control vertex
   with triples of knots

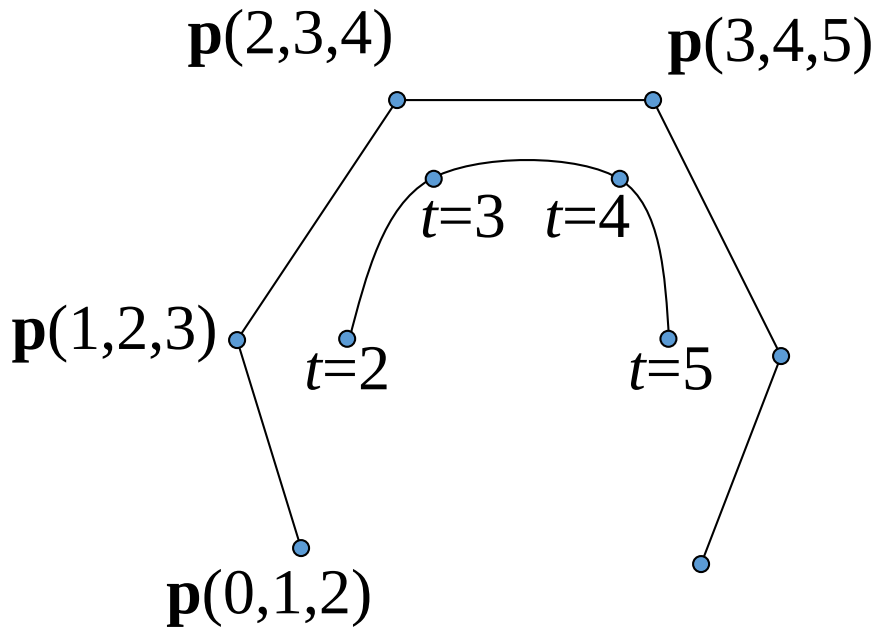


knot vector: [0 1 **2 3 4** 5 6 7]

The Blossoming Game

B-Spline Rules for Setting Up the Board

1. Create a knot vector
   (with two extra values at each end)
2. Label each control vertex
   with triples of knots

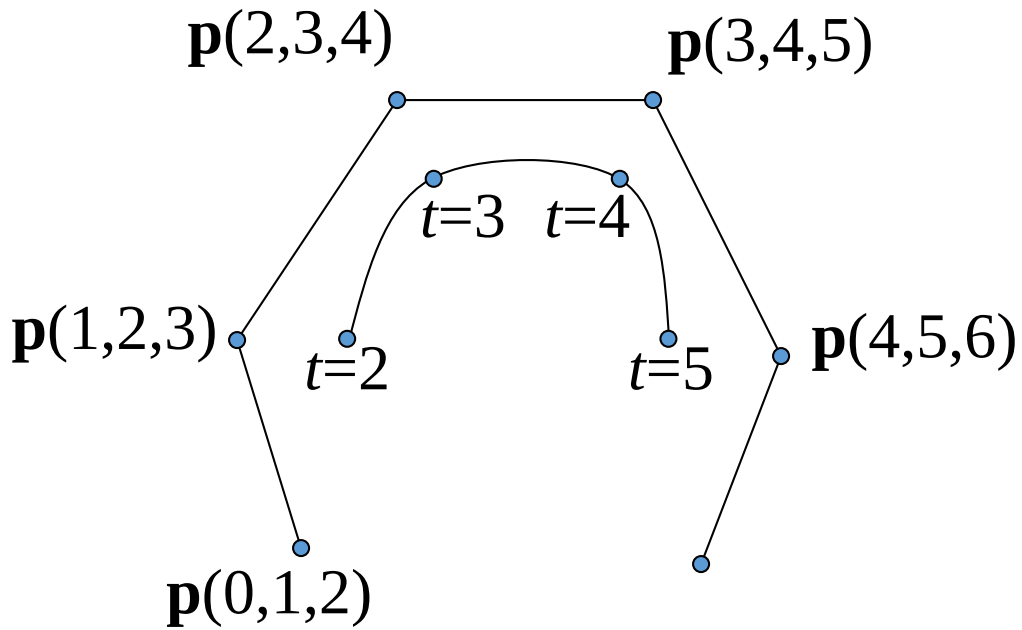


knot vector: [0 1 2 **3 4 5** 6 7]

The Blossoming Game

B-Spline Rules for Setting Up the Board

1. Create a knot vector
   (with two extra values at each end)
2. Label each control vertex
   with triples of knots

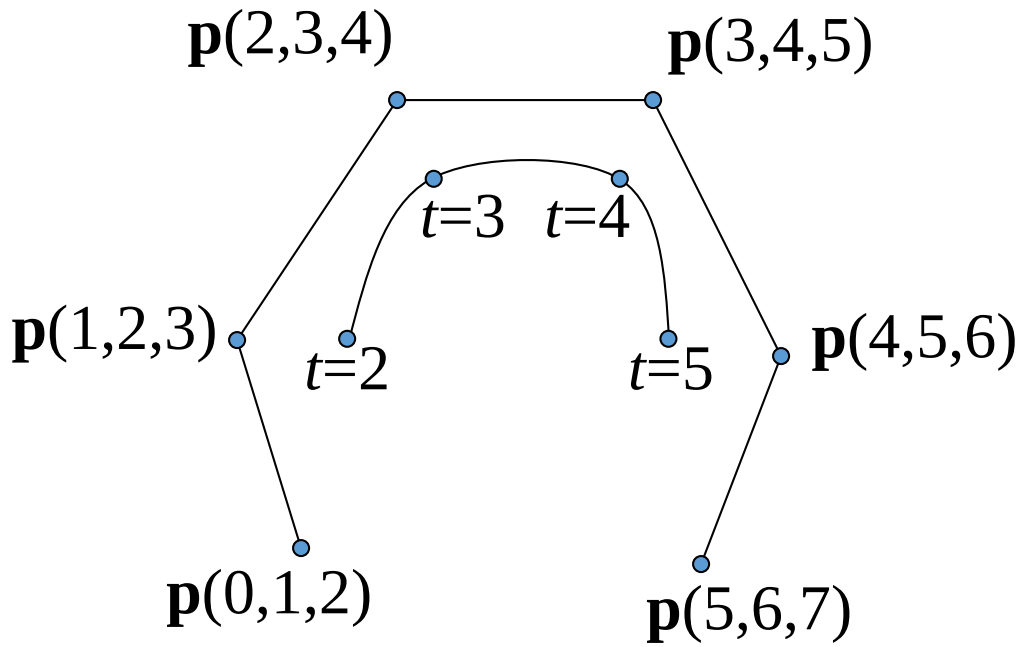


knot vector: [0 1 2 3 **4 5 6** 7]

The Blossoming Game

B-Spline Rules for Setting Up the Board

1. Create a knot vector
   (with two extra values at each end)
2. Label each control vertex
   with triples of knots

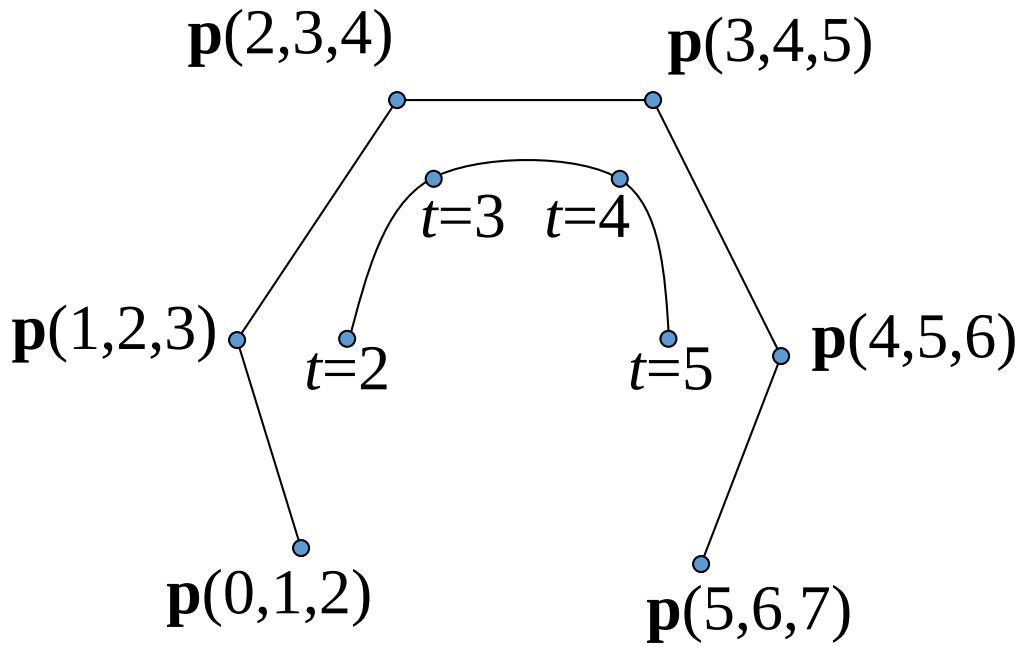


knot vector: [0 1 2 3 4 **5 6 7**]

The Blossoming Game

B-Spline Rules for Setting Up the Board

1. Create a knot vector
   (with two extra values at each end)
2. Label each control vertex
   with triples of knots



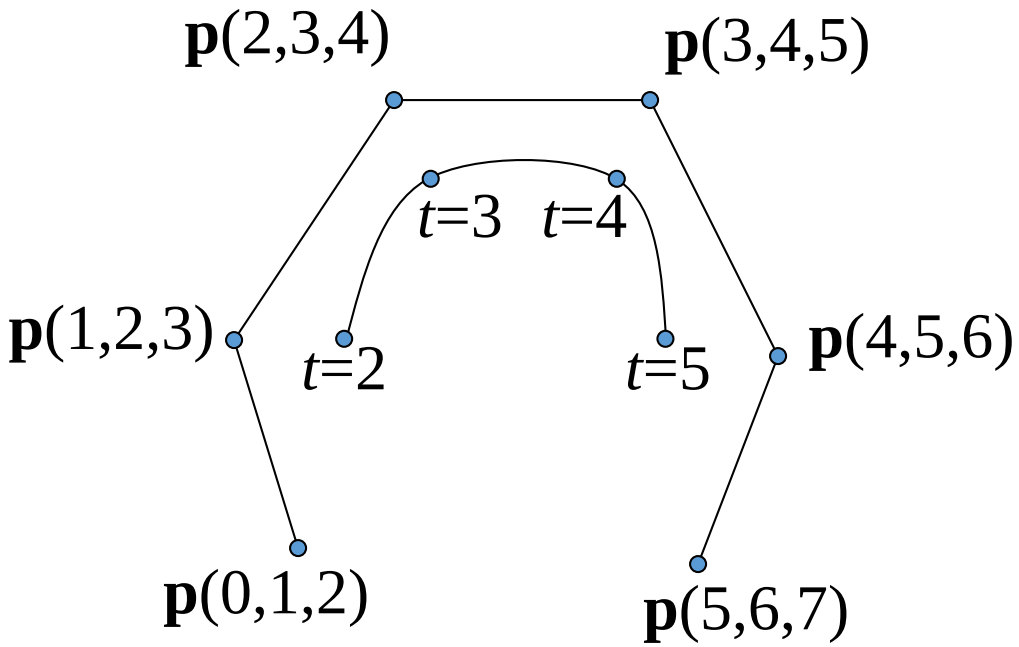
knot vector: [0 1 2 3 4 5 6 7]

Bohm Blossoms

B-Spline Rules for Winning the Game:

Convert a B-Spline to a Bezier Curve

- Bohm Algorithm
- Trick: Think of each segment as a Bezier curve



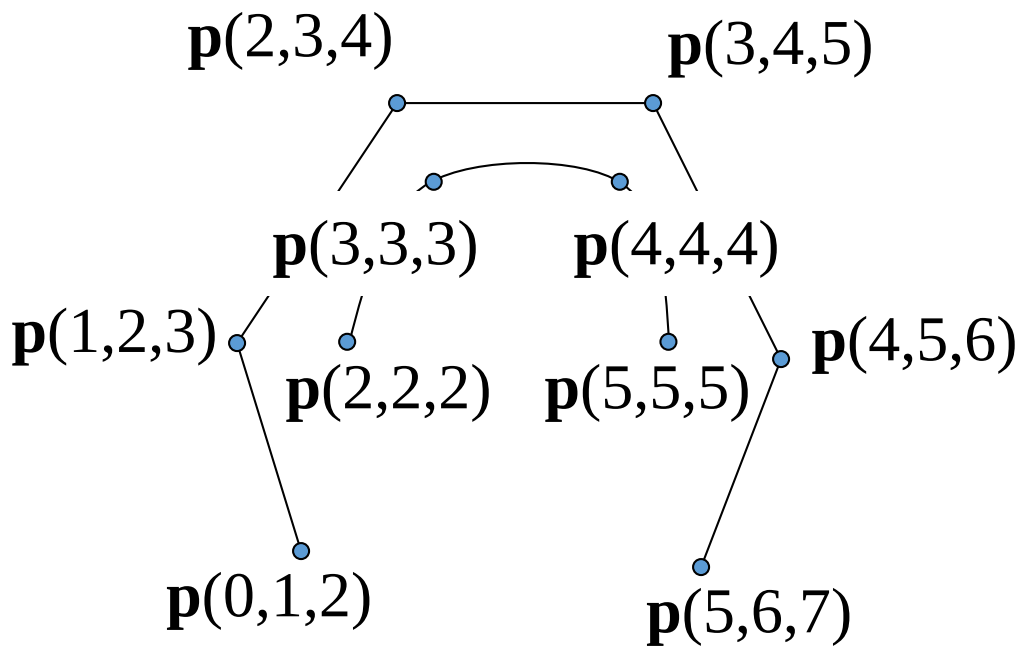
knot vector: [0 1 2 3 4 5 6 7]

Bohm Blossoms

B-Spline Rules for Winning the Game:

Convert a B-Spline to a Bezier Curve

- Bohm Algorithm
- Trick: Think of each segment as a Bezier curve



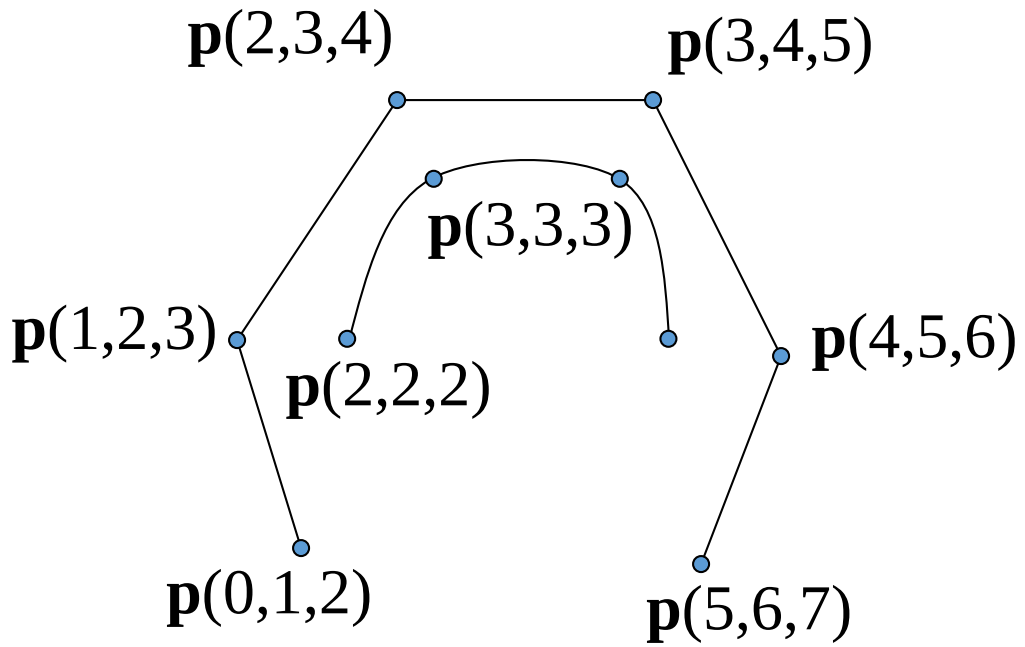
knot vector: [0 1 2 3 4 5 6 7]

Bohm Blossoms

B-Spline Rules for Winning the Game:

Convert a B-Spline to a Bezier Curve

- Bohm Algorithm
- Trick: Think of each segment as a Bezier curve
- Where should the other two control points go for the [2,3] segment?



knot vector: [0 1 2 3 4 5 6 7]

Bohm Blossoms

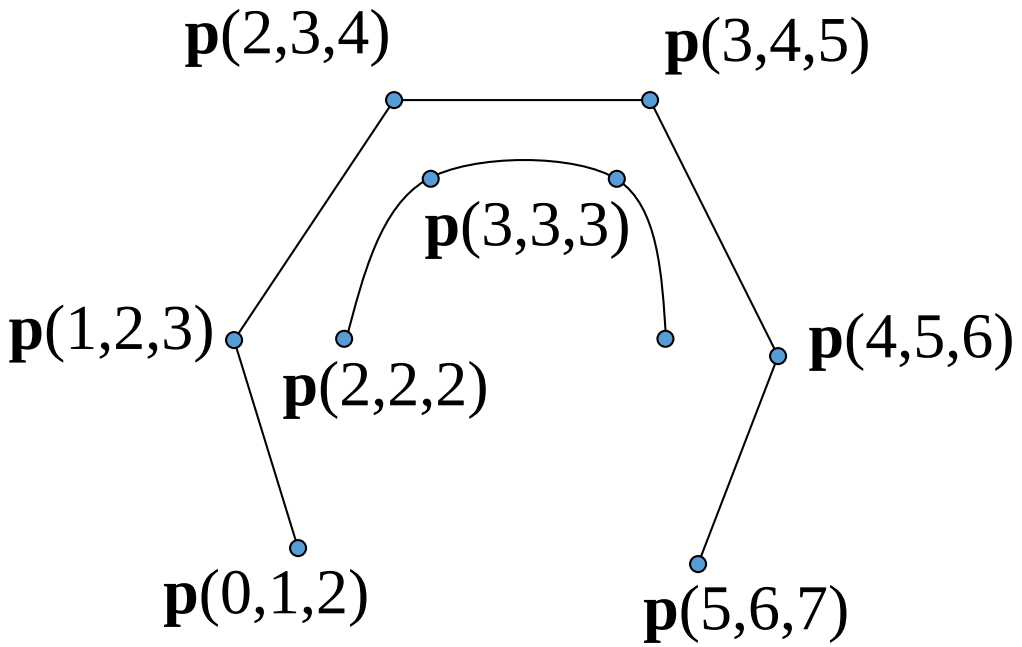
B-Spline Rules for Winning the Game:

Convert a B-Spline to a Bezier Curve

- Bohm Algorithm
- Trick: Think of each segment as a Bezier curve
- Where should the other two control points go for the [2,3] segment?
- Need to find:

p(2,2,3)

p(2,3,3)



knot vector: [0 1 2 3 4 5 6 7]

Bohm Blossoms

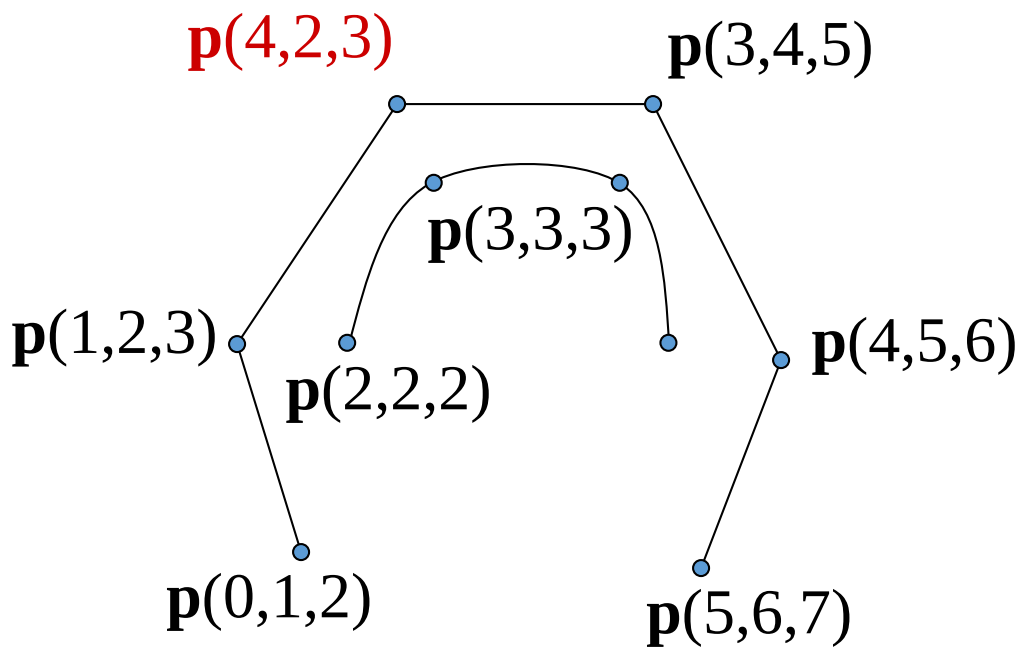
B-Spline Rules for Winning the Game:

Convert a B-Spline to a Bezier Curve

- Bohm Algorithm
- Trick: Think of each segment as a Bezier curve
- Where should the other two control points go for the [2,3] segment?
- Need to find:

p(2,2,3)

p(2,3,3)



knot vector: [0 1 2 3 4 5 6 7]

Bohm Blossoms

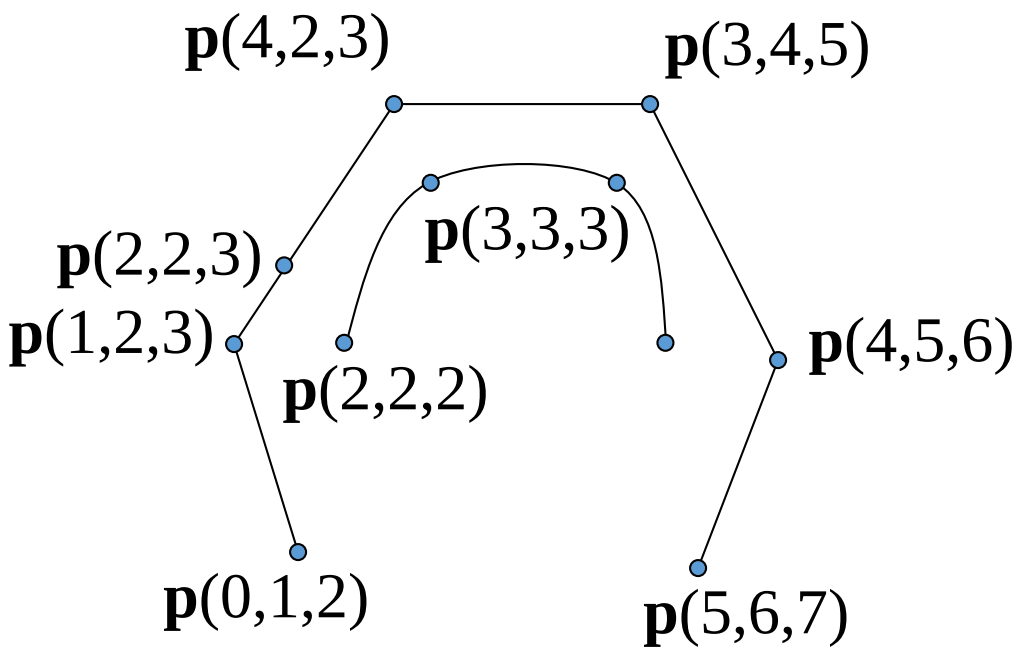
B-Spline Rules for Winning the Game:

Convert a B-Spline to a Bezier Curve

- Bohm Algorithm
- Trick: Think of each segment as a Bezier curve
- Where should the other two control points go for the [2,3] segment?
- Need to find:

p(2,2,3) = 2/3 **p**(1,2,3) + 1/3 **p**(4,2,3)

p(2,3,3)



knot vector: [0 1 2 3 4 5 6 7]

Bohm Blossoms

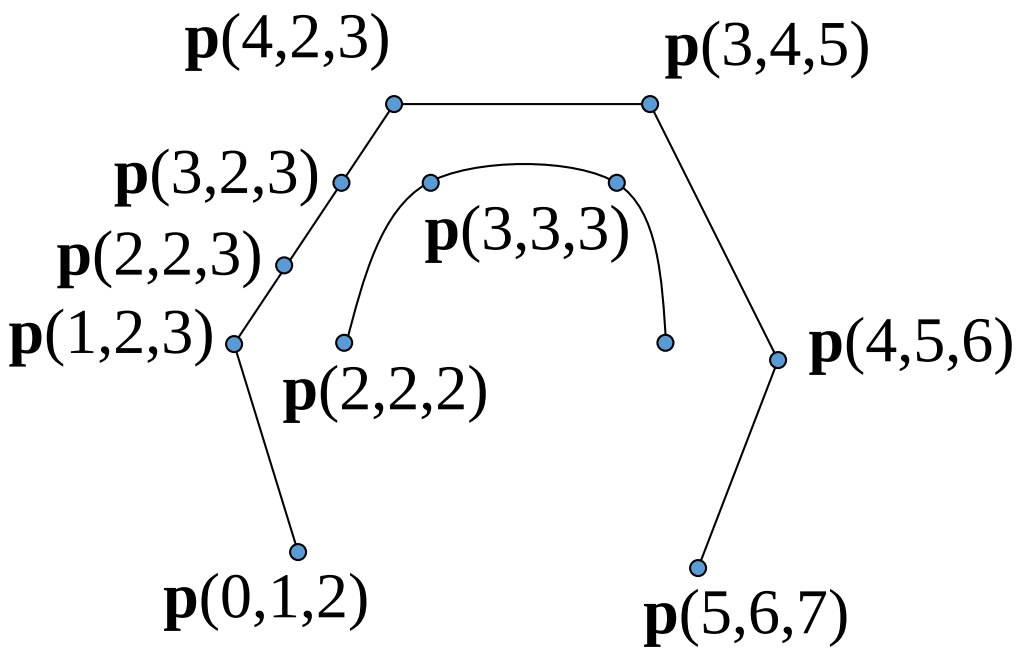
B-Spline Rules for Winning the Game:

Convert a B-Spline to a Bezier Curve

- Bohm Algorithm
- Trick: Think of each segment as a Bezier curve
- Where should the other two control points go for the [2,3] segment?
- Need to find:

p(2,2,3) = 2/3 **p**(1,2,3) + 1/3 **p**(4,2,3)

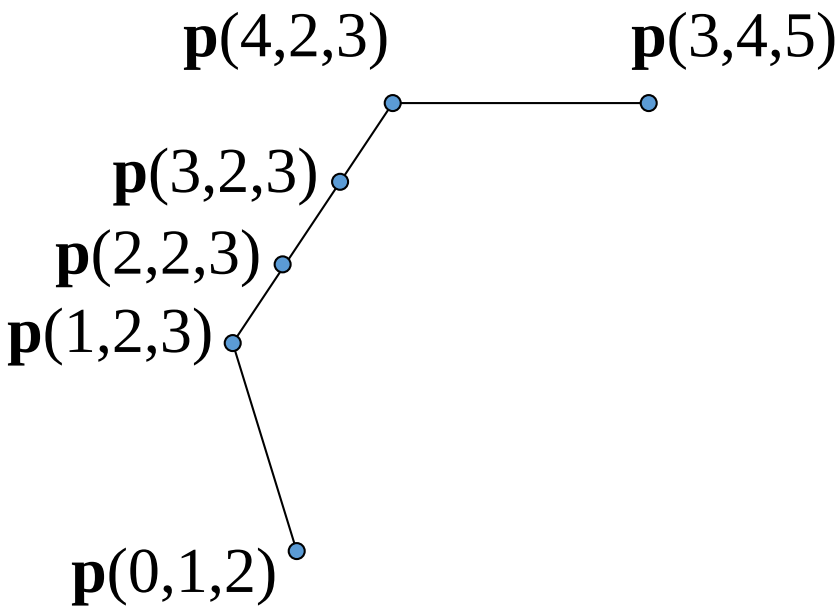
p(2,3,3) = 1/3 **p**(1,2,3) + 2/3 **p**(4,2,3)



knot vector: [0 1 2 3 4 5 6 7]

Bohm Blossoms

- Where are the endpoints located?

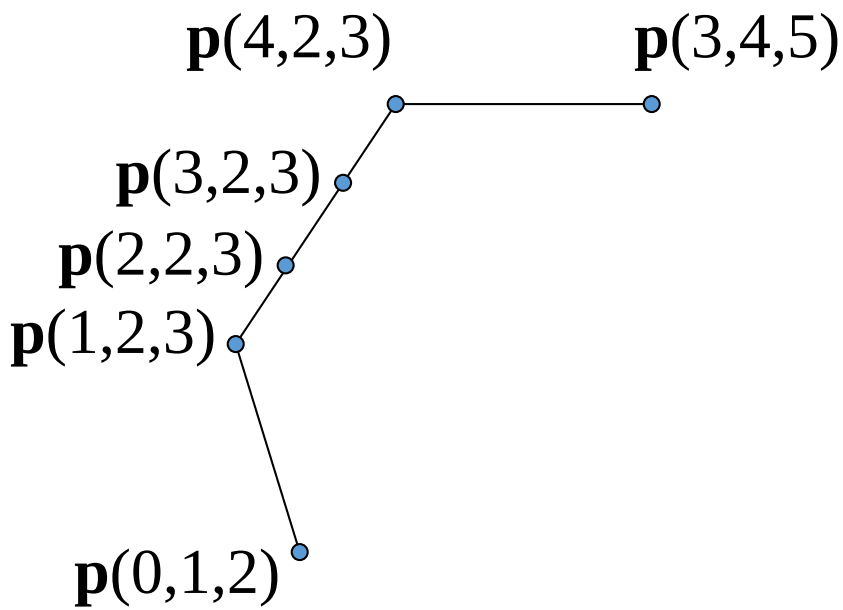


Bohm Blossoms

- Where are the endpoints located?
- Need to find:

p(2,2,2) =

p(3,3,3) =



Bohm Blossoms

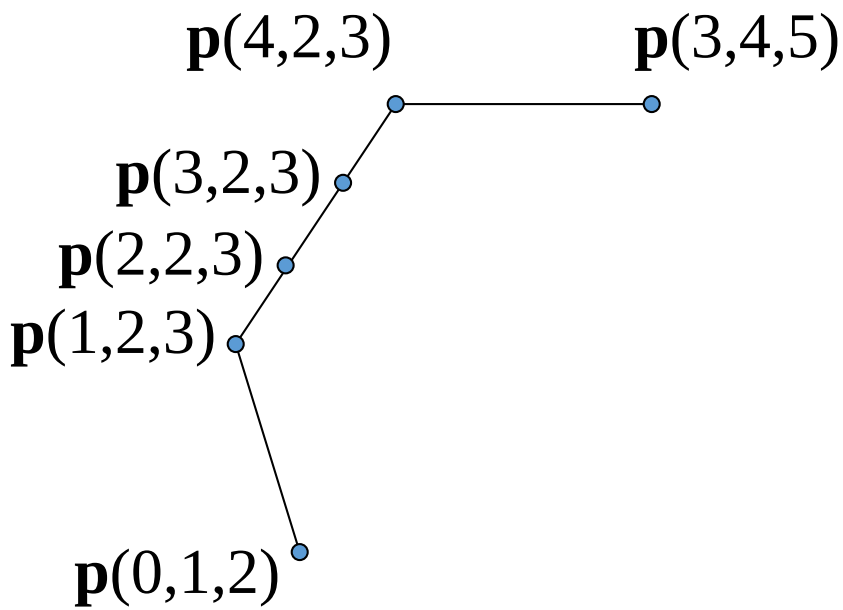
- Where are the endpoints located?
- Need to find:

p(2,1,2) =

p(3,4,3) =

p(2,2,2) =

p(3,3,3) =



Bohm Blossoms

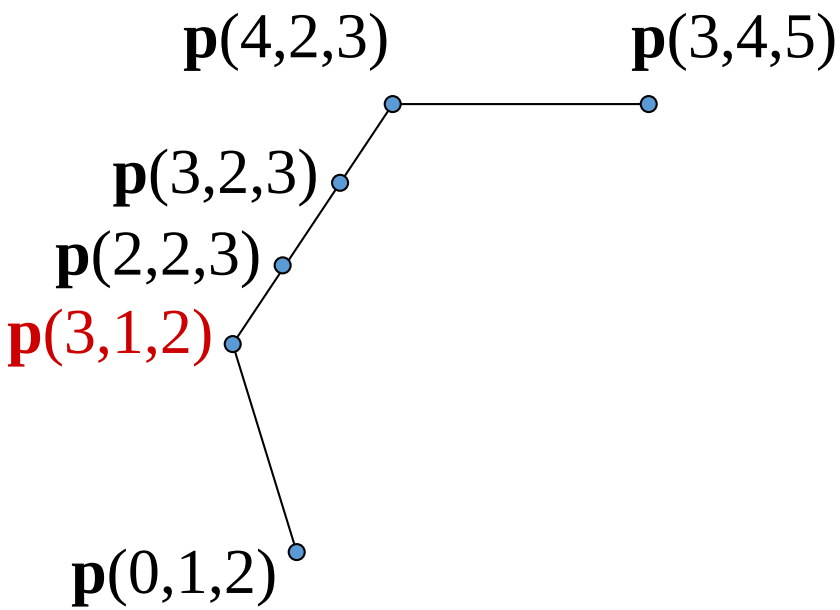
- Where are the endpoints located?
- Need to find:

p(2,1,2) =

p(3,4,3) =

p(2,2,2) =

p(3,3,3) =



Bohm Blossoms

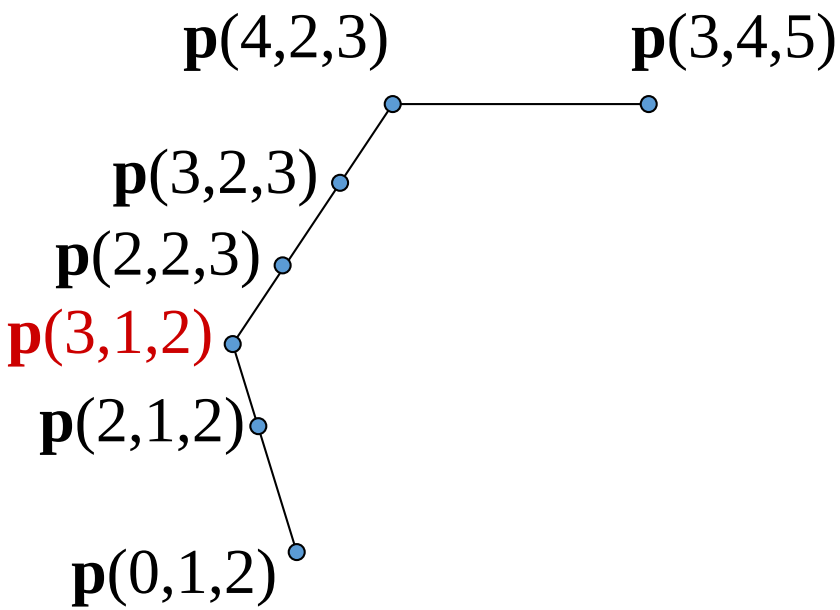
- Where are the endpoints located?
- Need to find:

p(2,1,2) = 1/3 **p**(0,1,2) + 2/3 **p**(3,1,2)

p(3,4,3) =

p(2,2,2) =

p(3,3,3) =



Bohm Blossoms

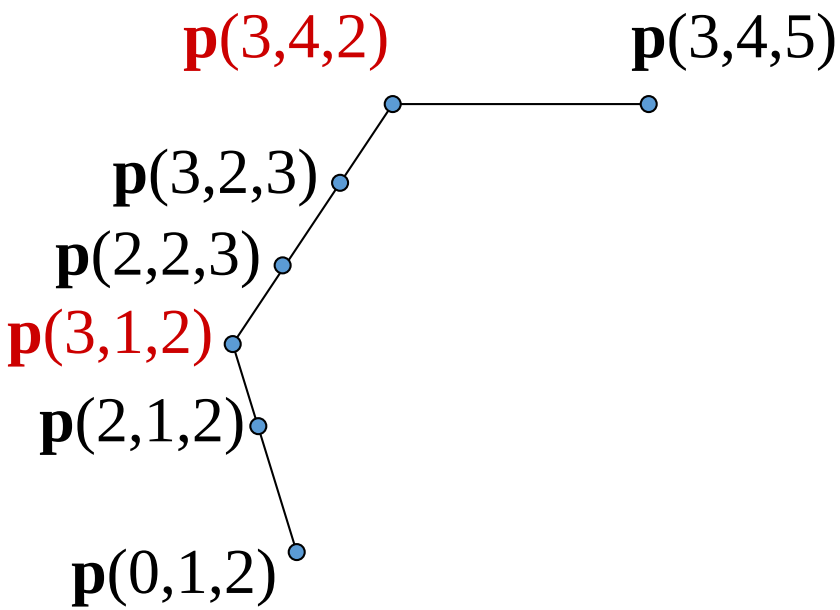
- Where are the endpoints located?
- Need to find:

p(2,1,2) = 1/3 **p**(0,1,2) + 2/3 **p**(3,1,2)

p(3,4,3) =

p(2,2,2) =

p(3,3,3) =



Bohm Blossoms

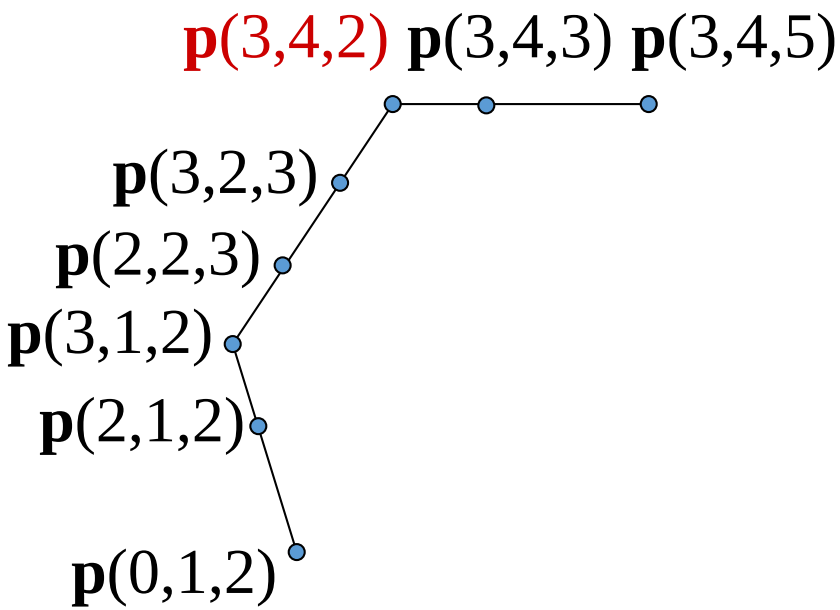
- Where are the endpoints located?
- Need to find:

$\mathbf{p}(2,1,2) = 1/3\ \mathbf{p}(0,1,2) + 2/3\ \mathbf{p}(3,1,2)$

$\mathbf{p}(3,4,3) = 2/3\ \mathbf{p}(3,4,2) + 1/3\ \mathbf{p}(3,4,5)$

$\mathbf{p}(2,2,2) =$

$\mathbf{p}(3,3,3) =$



Bohm Blossoms

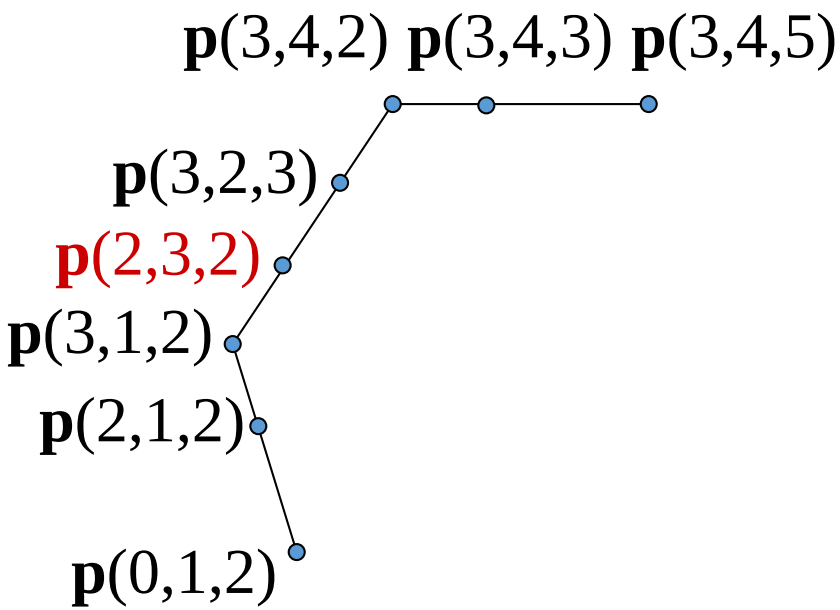
- Where are the endpoints located?
- Need to find:

p(2,1,2) = 1/3 **p**(0,1,2) + 2/3 **p**(3,1,2)

p(3,4,3) = 2/3 **p**(3,4,2) + 1/3 **p**(3,4,5)

p(2,2,2) =

p(3,3,3) =



Bohm Blossoms

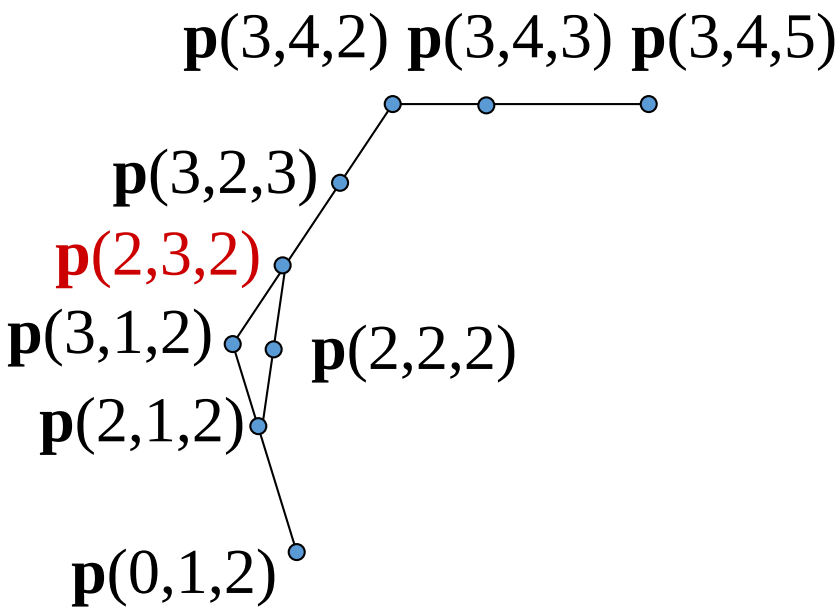
- Where are the endpoints located?
- Need to find:

p(2,1,2) = 1/3 **p**(0,1,2) + 2/3 **p**(3,1,2)

p(3,4,3) = 2/3 **p**(3,4,2) + 1/3 **p**(3,4,5)

p(2,2,2) = 1/2 **p**(2,1,2) + 1/2 **p**(2,3,2)

p(3,3,3) =



Bohm Blossoms

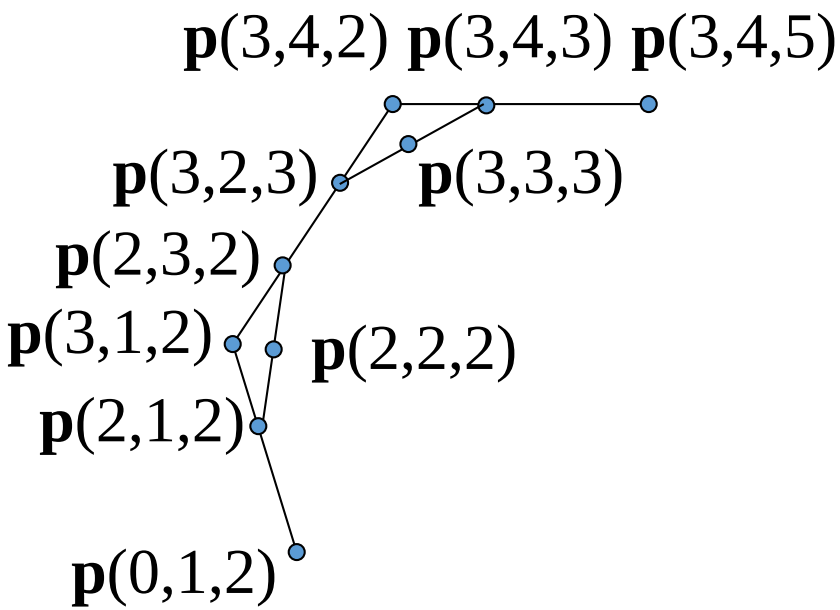
- Where are the endpoints located?
- Need to find:

$\mathbf{p}(2,1,2) = 1/3\ \mathbf{p}(0,1,2) + 2/3\ \mathbf{p}(3,1,2)$

$\mathbf{p}(3,4,3) = 2/3\ \mathbf{p}(3,4,2) + 1/3\ \mathbf{p}(3,4,5)$

$\mathbf{p}(2,2,2) = 1/2\ \mathbf{p}(2,1,2) + 1/2\ \mathbf{p}(2,3,2)$

$\mathbf{p}(3,3,3) = 1/2\ \mathbf{p}(3,2,3) + 1/2\ \mathbf{p}(3,4,3)$



Bohm Blossoms

- Where are the endpoints located?
- Need to find:

$\mathbf{p}(2,1,2) = 1/3\ \mathbf{p}(0,1,2) + 2/3\ \mathbf{p}(3,1,2)$

$\mathbf{p}(3,4,3) = 2/3\ \mathbf{p}(3,4,2) + 1/3\ \mathbf{p}(3,4,5)$

$\mathbf{p}(2,2,2) = 1/2\ \mathbf{p}(2,1,2) + 1/2\ \mathbf{p}(2,3,2)$

$\mathbf{p}(3,3,3) = 1/2\ \mathbf{p}(3,2,3) + 1/2\ \mathbf{p}(3,4,3)$