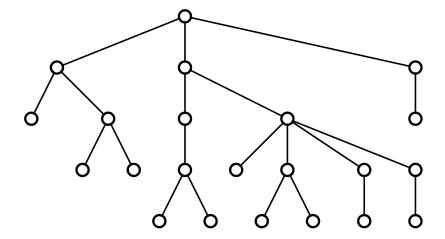




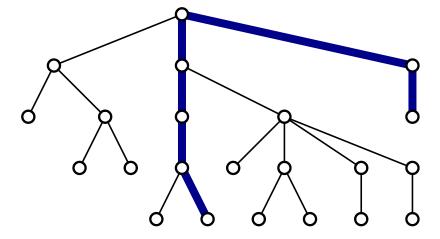
Drawing graphs with few segments on the grid

Philipp Kindermann FernUniversität in Hagen

Bertinoro Workshop on Graph Drawing

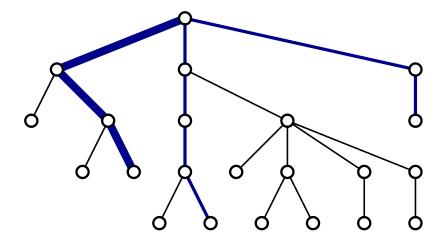


21 edges

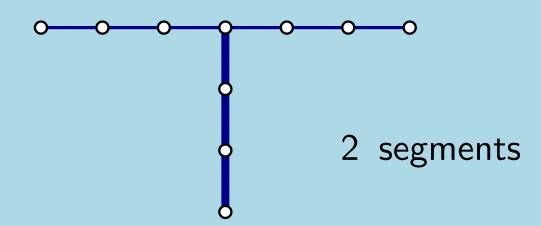


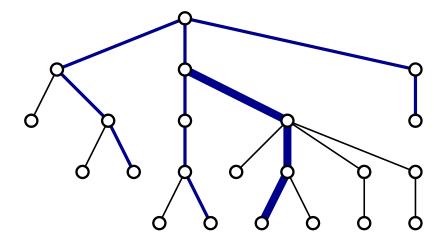
21 edges



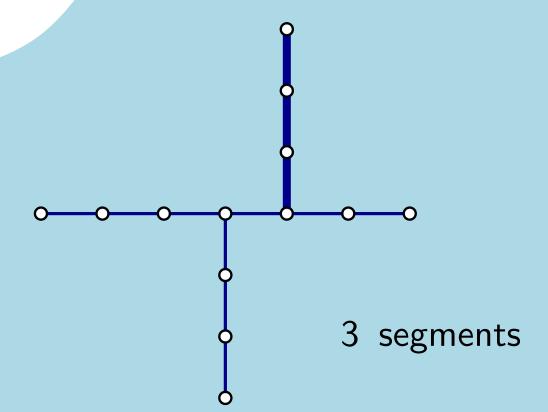


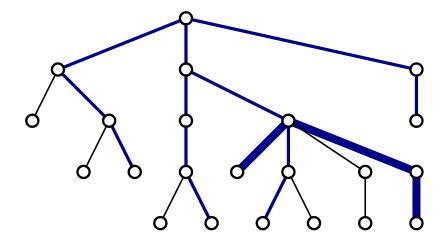
21 edges



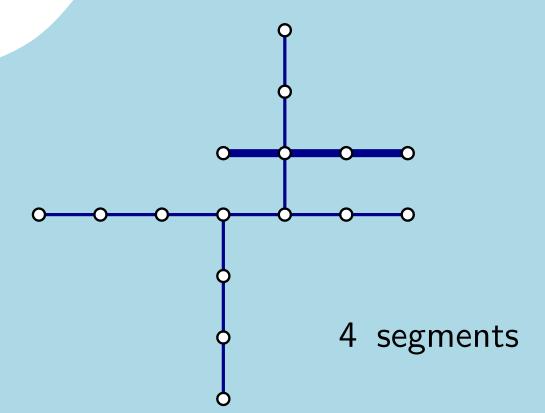


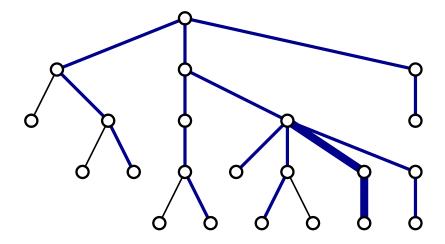
21 edges



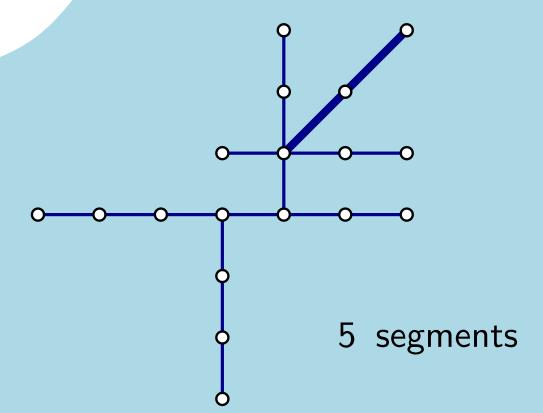


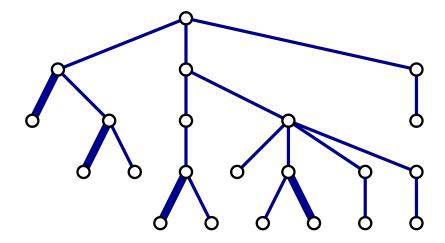
21 edges



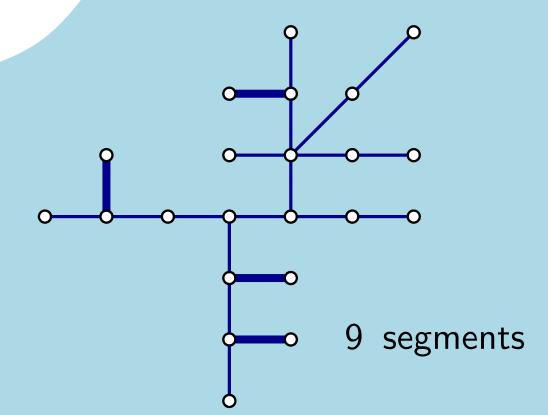


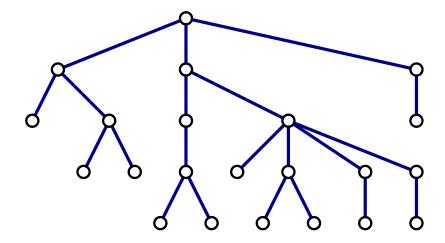
21 edges



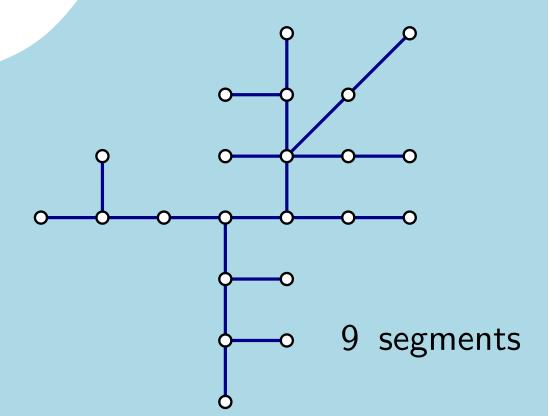


21 edges





21 edges



Class	Segments		
	Lower	Upper	

Class	Segments			
	Lower	Upper		
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]		

Class	Segments		
	Lower	Upper	
Tree		$\vartheta/2$ [1]	
max. outerplanar	n [1]	n [1]	

Class	Segments		
	Lower	Upper	
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]	
max. outerplanar 2-trees	$n \qquad [1] \ 3n/2 \ [1]$	n [1] $3n/2$ [1]	

Class	Segments		
	Lower	Upper	
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]	
max. outerplanar 2-trees 3-trees	n = [1] $3n/2 = [1]$ $2n = [1]$	$n \ 3n/2 \ [1] \ 2n \ [1]$	

Class	Segments			
	Lower	Upper		
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]		
max. outerplanar 2-trees 3-trees 2-connected	$egin{array}{cccc} n & [1] \\ 3n/2 & [1] \\ 2n & [1] \\ 2n & [1] \end{array}$	$n \ \ [1] \ \ 3n/2 \ \ [1] \ \ 2n \ \ [1] \ \ ?$		

Class	Segments			
	Lower	Upper		
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]		
max. outerplanar	n [1]	n [1]		
2-trees	3n/2 [1]	3n/2 [1]		
3-trees	2n [1]	2n [1]		
2-connected	2n [1]	?		
3-connected	2n [1]	5n/2 [1]		

Class	Segments			
	Lower	Upper		
Tree	$\vartheta/2$ [1]	artheta/2 [1]		
max. outerplanar	n [1]	n [1]		
2-trees	3n/2 [1]	3n/2 [1]		
3-trees	2n [1]	2n [1]		
2-connected	2n [1]	?		
3-connected	2n [1]	5n/2 [1]		
cubic 3-conn.	n/2 [3]	n/2 [2]		

Class	Segments			
	Lower	Upper		
Tree	$\vartheta/2$ [1]	artheta/2 [1]		
max. outerplanar	n [1]	n [1]		
2-trees	3n/2 [1]	3n/2 [1]		
3-trees	2n [1]	2n [1]		
2-connected	2n [1]	?		
3-connected	2n [1]	5n/2 [1]		
cubic 3-conn.	n/2 [3]	n/2 [2]		
Triangulation	2 <i>n</i> [4]	7n/3 [4]		

^[1] Dujmović et al. 2007 [2] Igamberdiev et al. 2015 [3] Mondal et al. 2013

Class	Segments		
	Lower	Upper	
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]	
max. outerplanar	n [1]	n [1]	
2-trees	3n/2 [1]	3n/2 [1]	
3-trees	2n [1]	2n [1]	
2-connected	2n [1]	?	
3-connected	2n [1]	5n/2 [1]	
cubic 3-conn.	n/2 [3]	n/2 [2]	
Triangulation	2n [4]	7n/3 [4]	
Planar	2n [4]	16n/3 - e [4]	

^[1] Dujmović et al. 2007 [2] Igamberdiev et al. 2015 [3] Mondal et al. 2013

Class	Segments		Grid Segments	
	Lower	Upper	Segm.	Area
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]		
max. outerplanar	n [1]	n [1]		
2-trees	3n/2 [1]	3n/2 [1]		
3-trees	2n [1]	2n [1]		
2-connected	2n [1]	?		
3-connected	2n [1]	5n/2 [1]		
cubic 3-conn.	n/2 [3]	n/2 [2]		
Triangulation	2 <i>n</i> [4]	7n/3 [4]		
Planar	2n [4]	16n/3 - e [4]		

^[1] Dujmović et al. 2007 [2] Igamberdiev et al. 2015 [3] Mondal et al. 2013

Class	Segments		Grid Segments	
	Lower	Upper	Segm.	Area
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]		
max. outerplanar	n [1]	n [1]		
2-trees	3n/2 [1]	3n/2 [1]		
3-trees	2n [1]	2n [1]		
2-connected	2n [1]	?		
3-connected	2n [1]	5n/2 [1]		
cubic 3-conn.	n/2 [3]	n/2 [2]	n/2 [2]	$O(n) \times O(n)$
Triangulation	2n [4]	7n/3 [4]		
Planar	2n [4]	16n/3 - e [4]		

^[1] Dujmović et al. 2007 [2] Igamberdiev et al. 2015 [3] Mondal et al. 2013

Class	Segments		Grid	id Segments	
	Lower	Upper	Segm.	Area	
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]	3 <i>n</i> /4 [5]	$O(n^2) \times O(n^{1.58})$	
max. outerplanar	n [1]	n [1]			
2-trees	3n/2 [1]	3n/2 [1]			
3-trees	2n [1]	2n [1]			
2-connected	2n [1]	?			
3-connected	2n [1]	5n/2 [1]			
cubic 3-conn.	n/2 [3]	n/2 [2]	n/2 [2]	$O(n) \times O(n)$	
Triangulation	2n [4]	7n/3 [4]			
Planar	2n [4]	16n/3 - e [4]			

^[1] Dujmović et al. 2007 [2] Igamberdiev et al. 2015 [3] Mondal et al. 2013

^[4] Durocher & Mondal 2014

Class	Segments		Grid	id Segments	
	Lower	Upper	Segm.	Area	
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]	$3n/4$ [5] $\vartheta/2$ [5]	$O(n^2) \times O(n^{1.58})$ quasipolynomial	
max. outerplanar	n [1]	n [1]			
2-trees	3n/2 [1]	3n/2 [1]			
3-trees	2n [1]	2n [1]			
2-connected	2n [1]	?			
3-connected	2n [1]	5n/2 [1]			
cubic 3-conn.	n/2 [3]	n/2 [2]	n/2 [2]	$O(n) \times O(n)$	
Triangulation	2n [4]	7n/3 [4]			
Planar	2n [4]	16n/3 - e [4]			

^[1] Dujmović et al. 2007 [2] Igamberdiev et al. 2015 [3] Mondal et al. 2013

^[4] Durocher & Mondal 2014

^[5] Hültenschmidt et al. 2017

Class	Segments		Grid Segments	
	Lower	Upper	Segm.	Area
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]	$3n/4$ [5] $\vartheta/2$ [5]	$O(n^2) \times O(n^{1.58})$ quasipolynomial
max. outerplanar	n [1]	n [1]	3n/2 [5]	$O(n) \times O(n^2)$
2-trees	3n/2 [1]	3n/2 [1]		
3-trees	2n [1]	2n [1]		
2-connected	2n [1]	?		
3-connected	2n [1]	5n/2 [1]		
cubic 3-conn.	n/2 [3]	n/2 [2]	n/2 [2]	$O(n) \times O(n)$
Triangulation	2n [4]	7n/3 [4]		
Planar	2n [4]	16n/3 - e [4]		

^[1] Dujmović et al. 2007 [2] Igamberdiev et al. 2015 [3] Mondal et al. 2013

^[4] Durocher & Mondal 2014

^[5] Hültenschmidt et al. 2017

Segments		Grid Segments	
Lower	Upper	Segm.	Area
$\vartheta/2$ [1]	$\vartheta/2$ [1]		$O(n^2) \times O(n^{1.58})$ quasipolynomial
n [1]	n [1]	3n/2 [5]	$O(n) \times O(n^2)$
3n/2 [1]	3n/2 [1]		
2n [1]	2n [1]	8n/3 [5]	$O(n) \times O(n^2)$
2n [1]	?		
2n [1]	5n/2 [1]		
n/2 [3]	n/2 [2]	n/2 [2]	$O(n) \times O(n)$
2n [4]	7n/3 [4]		
2n [4]	16n/3 - e [4]		
	Lower $ \frac{\vartheta}{2} [1] $ $ \frac{n}{3n/2} [1] $ $ \frac{2n}{2n} [1] $ $ \frac{2n}{2n} [1] $ $ \frac{2n}{2n} [1] $ $ \frac{2n}{2n} [4] $	Lower Upper $ \frac{\vartheta}{2} [1] \frac{\vartheta}{2} [1] \\ n [1] n [1] \\ 3n/2 [1] 3n/2 [1] \\ 2n [1] 2n [1] \\ 2n [1] ? \\ 2n [1] ? \\ 2n [1] n/2 [1] \\ n/2 [3] n/2 [2] \\ 2n [4] 7n/3 [4]$	Lower Upper Segm. $\vartheta/2$ [1] $\vartheta/2$ [1] $3n/4$ [5] n [1] n [1] $3n/2$ [5] $3n/2$ [1] $3n/2$ [5] $3n/2$ [1] $3n/2$ [5] $2n$ [1] $2n$ [1] $8n/3$ [5] $2n$ [1] $?$ $2n$ [1] $5n/2$ [1] $n/2$ [2] $2n$ [4] $7n/3$ [4] $n/2$ [2]

^[1] Dujmović et al. 2007 [2] Igamberdiev et al. 2015 [3] Mondal et al. 2013

^[4] Durocher & Mondal 2014

Class	Segments		Grid Segments	
	Lower	Upper	Segm.	Area
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]	$3n/4$ [5] $\vartheta/2$ [5]	$O(n^2) \times O(n^{1.58})$ quasipolynomial
max. outerplanar	n [1]	n [1]	3n/2 [5]	$O(n) \times O(n^2)$
2-trees	3n/2 [1]	3n/2 [1]		?
3-trees	2n [1]	2n [1]	8n/3 [5]	$O(n) \times O(n^2)$
2-connected	2n [1]	?		7
3-connected	2n [1]	5n/2 [1]		!
cubic 3-conn.	n/2 [3]	n/2 [2]	n/2 [2]	$O(n) \times O(n)$
Triangulation	2n [4]	7n/3 [4]		2
Planar	2n [4]	16n/3 - e [4]		!

^[1] Dujmović et al. 2007 [2] Igamberdiev et al. 2015 [3] Mondal et al. 2013

^[4] Durocher & Mondal 2014

Class	Segments		Grid	d Segments	
	Lower	Upper	Segm.	Area	
Tree	$\vartheta/2$ [1]	$\vartheta/2$ [1]	$3n/4$ [5] $\vartheta/2$ [5]	$O(n^2) \times O(n^{1.58})$ quasipolynomial	
max. outerplanar	n [1]	n [1]	3n/2 [5]	$O(n) \times O(n^2)$	
2-trees	3n/2 [1]	3n/2 [1]		?	
3-trees	2n [1]	2n [1]	8n/3 [5]	$O(n) \times O(n^2)$	
2-connected	2n [1]	?		7	
3-connected	2n [1]	5n/2 [1]		!	
cubic 3-conn.	n/2 [3]	n/2 [2]	n/2 [2]	$O(n) \times O(n)$	
Triangulation	2n [4]	7n/3 [4]		2	
Planar	2n [4]	16n/3 - e [4]		!	
Series-parallel,					

^[1] Dujmović et al. 2007 [2] Igamberdiev et al. 2015 [3] Mondal et al. 2013

^[4] Durocher & Mondal 2014

^[5] Hültenschmidt et al. 2017