

6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

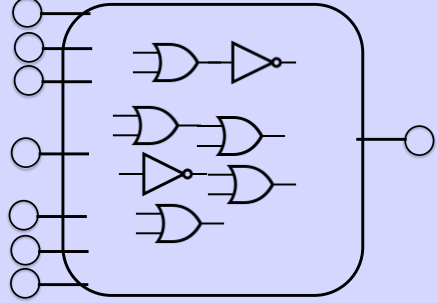
Mathematics for Computer Science
 MIT 6.042J/18.062J

SAT Reduces to 3-Coloring

Albert R Meyer, March 4, 2015

6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Circuit SAT



Is there an assignment of T's and F's to the inputs that yields output T?

Albert R Meyer, March 4, 2015

SATcolor.2

6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

Circuit SAT

Create graph whose 3-colorings simulate circuit behavior

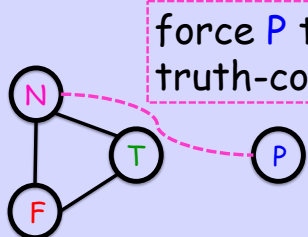
Is there an assignment of T's and F's to the inputs that yields output T?

Albert R Meyer, March 4, 2015

SATcolor.3

6	9	13	7
12	10	5	
3	1	4	14
15	8	11	2

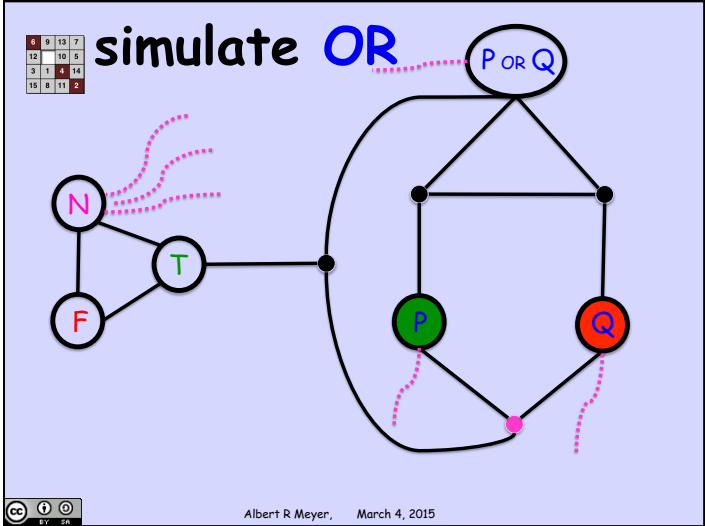
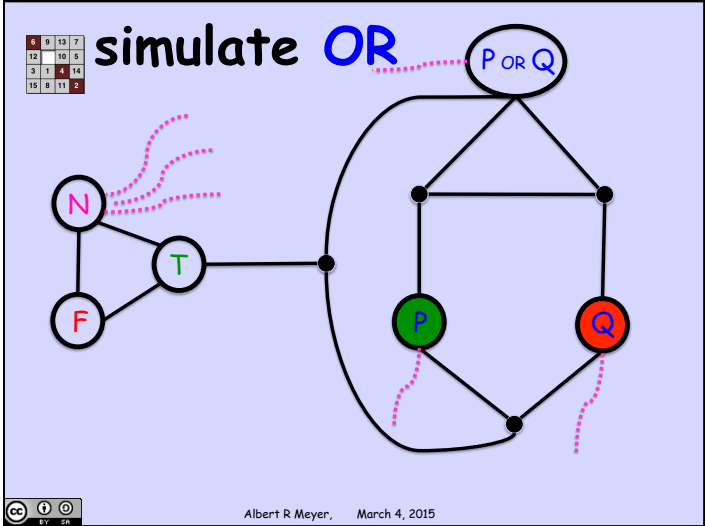
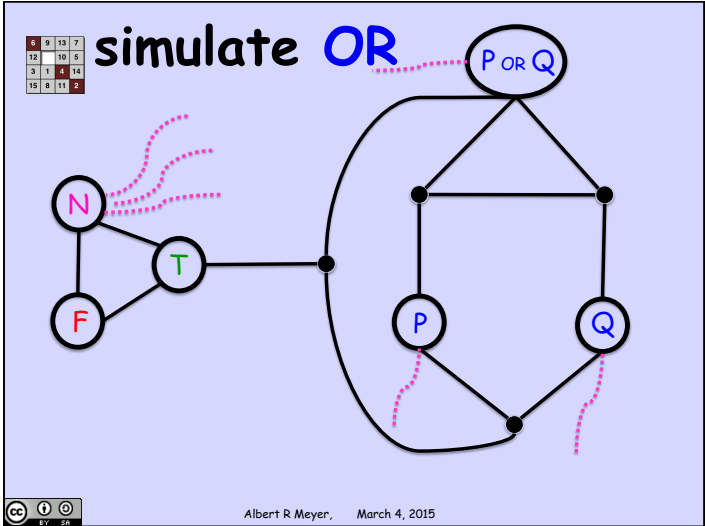
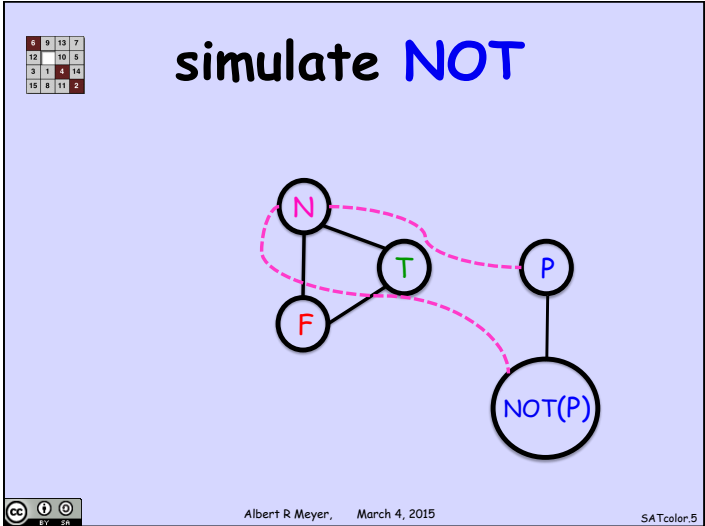
Truth Colors

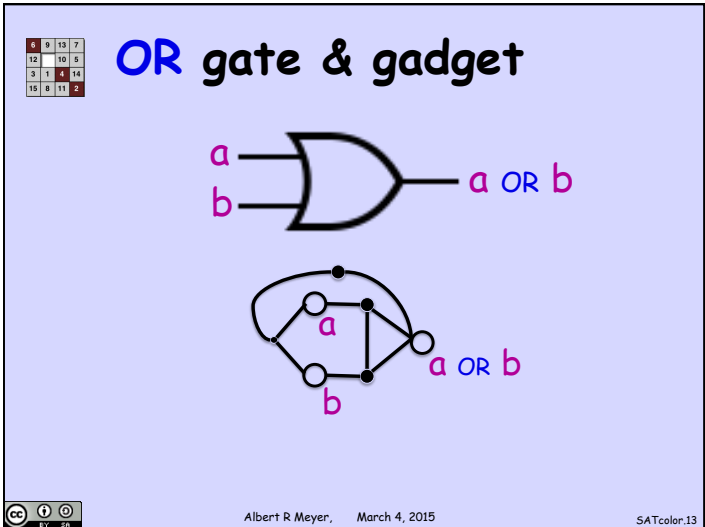
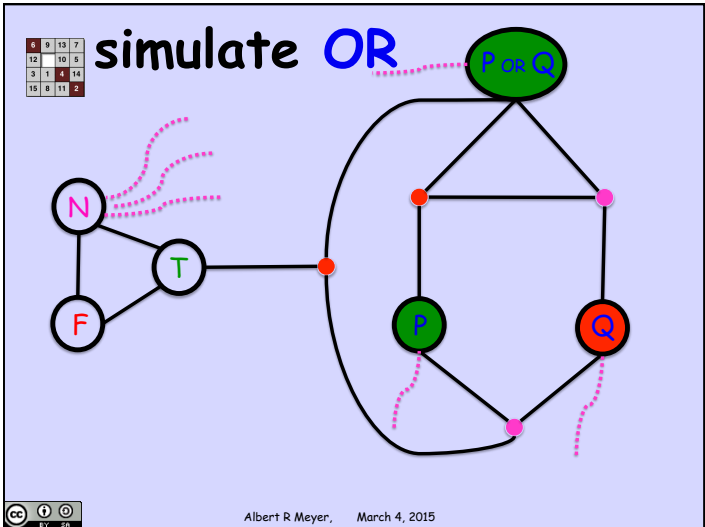
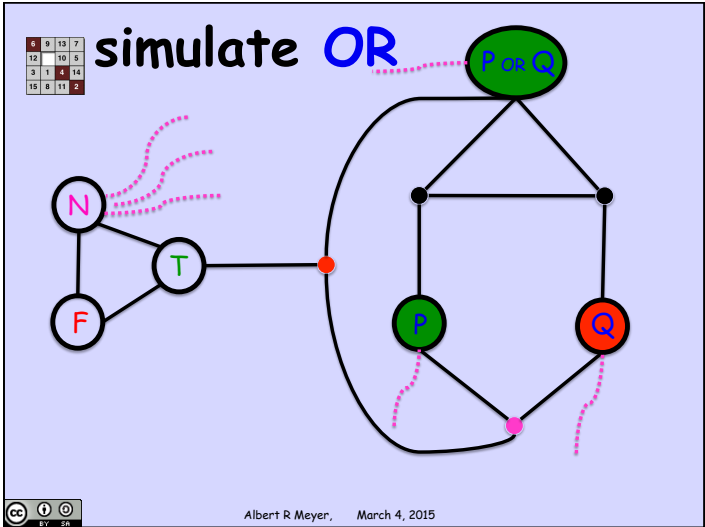
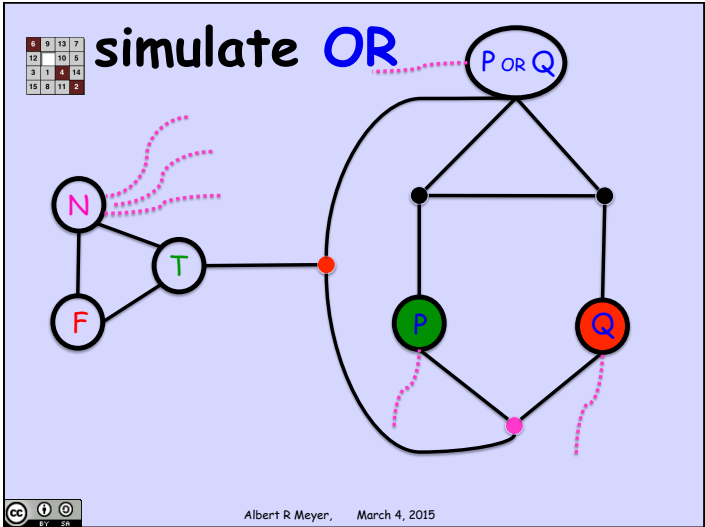


force P to be truth-colored

Albert R Meyer, March 4, 2015

SATcolor.4





NOT gate & gadget

Albert R Meyer, March 4, 2015 SATcolor:14

Circuit SAT

Albert R Meyer, March 4, 2015 SATcolor:15

Circuit SAT

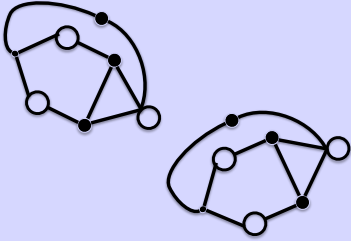
Albert R Meyer, March 4, 2015 SATcolor:16

Circuit SAT

Albert R Meyer, March 4, 2015 SATcolor:17

Circuit SAT

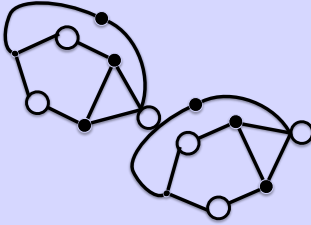
4	8	12	7
12	10	5	
3	1	4	14
15	6	11	2



Albert R Meyer, March 4, 2015 SATcolor:18

Circuit SAT

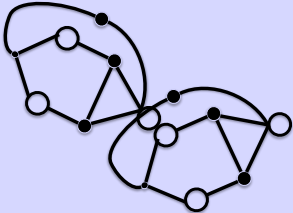
4	8	12	7
12	10	5	
3	1	4	14
15	6	11	2



Albert R Meyer, March 4, 2015 SATcolor:19

Circuit SAT

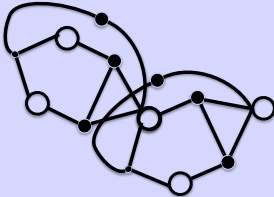
4	8	12	7
12	10	5	
3	1	4	14
15	6	11	2



Albert R Meyer, March 4, 2015 SATcolor:20

Circuit SAT

4	8	12	7
12	10	5	
3	1	4	14
15	6	11	2



Albert R Meyer, March 4, 2015 SATcolor:21

Circuit SAT

Albert R Meyer, March 4, 2015 SATcolor.22

Circuit SAT

Albert R Meyer, March 4, 2015 SATcolor.23

Circuit SAT

force output T

graph is 3-colorable iff circuit is in SAT

Albert R Meyer, March 4, 2015 SATcolor.24

SAT vs 3-Color


SAT and 3-color stand and fall together

Albert R Meyer, March 4, 2015 SATcolor.26

6	9	12	7
12	10	5	
3	1	4	14
15	8	11	2

SAT vs 3-Color

SAT and 3-color stand and fall together: there is an "efficient" (polynomial time) SAT procedure iff there is one for 3-color.




Albert R Meyer, March 4, 2015

SATcolor.27

6	9	12	7
12	10	5	
3	1	4	14
15	8	11	2

SAT vs 3-Color

SAT and 3-color stand and fall together: there is an "efficient" (polynomial time) SAT procedure iff there is one for 3-color. Both problems are **NP-complete**.



Albert R Meyer, March 4, 2015

SATcolor.28