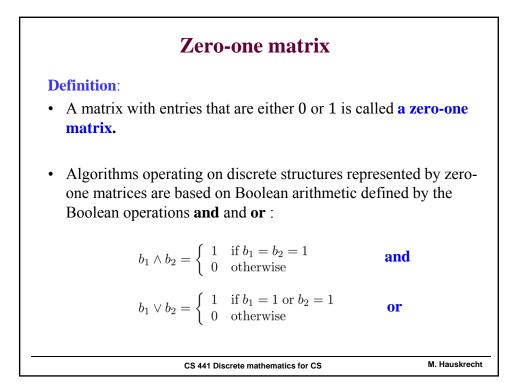
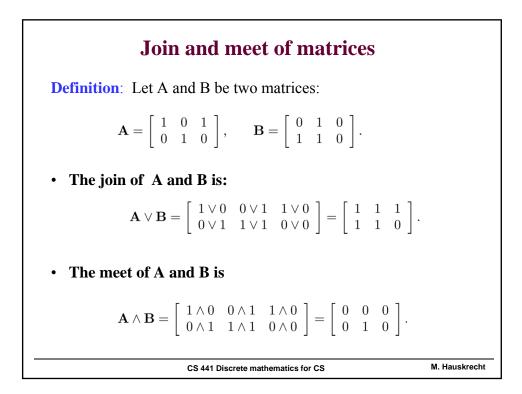
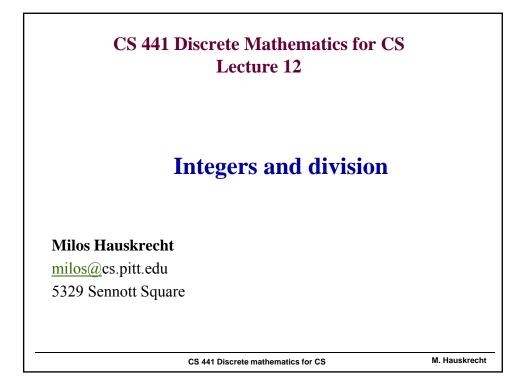
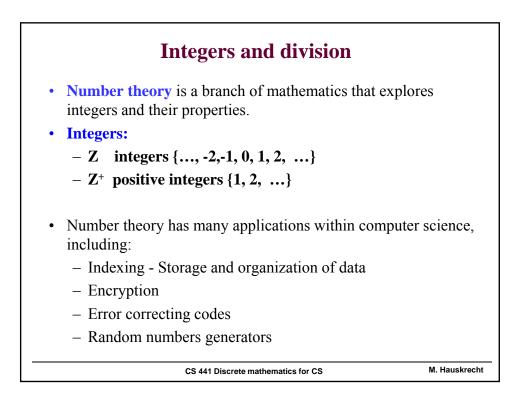


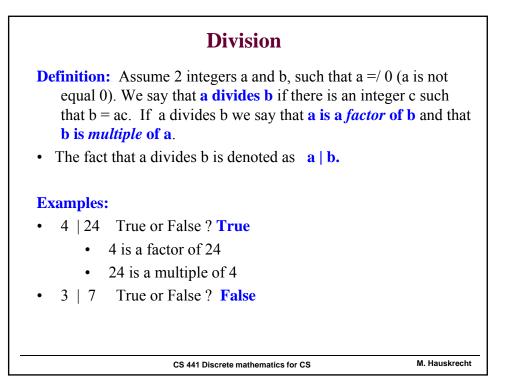
Symmetric matrix						
	e matri = [a _{ij}] :			alled symmetric if $\mathbf{A} = \mathbf{A}^{\mathrm{T}}$. etric if $a_{ij} = a_{ji}$ for <i>i</i> and <i>j</i> with	1≤ <i>i</i> ≤ <i>n</i>	
• Example	e:					
	1	1	0	0		
	1	0	1	0		
	0	1	1	1		
	0	0	1	0		
• Is it a sy	mmetr	ric m	atrix	? yes		
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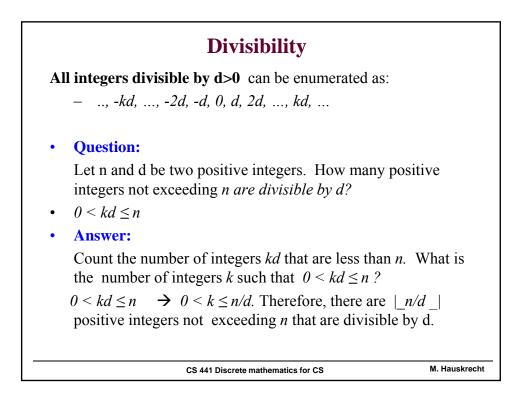






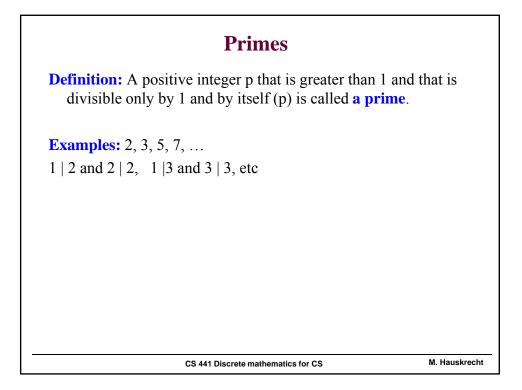


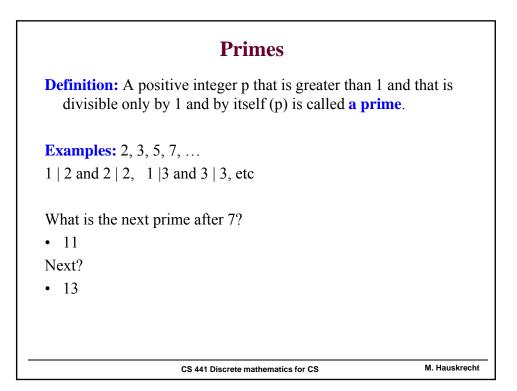


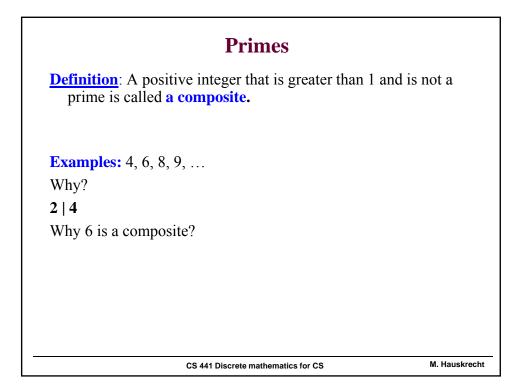


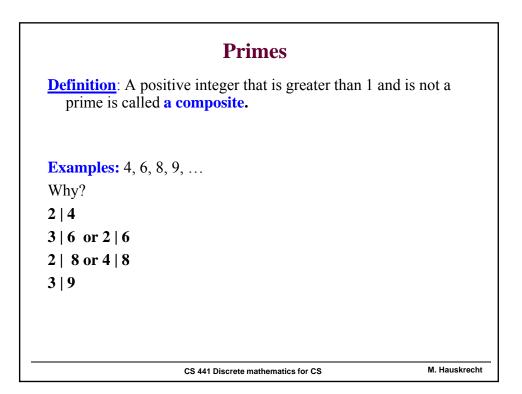
Divisibility **Properties:** Let a, b, c be integers. Then the following hold: • 1. if $a \mid b$ and $a \mid c$ then $a \mid (b+c)$ 2. if a | b then a | bc for all integers c 3. if $a \mid b$ and $b \mid c$ then $a \mid c$ **Proof of 1:** if $a \mid b$ and $a \mid c$ then $a \mid (b + c)$ from the definition of divisibility we get: ٠ b=au and c=av where u,v are two integers. Then (b+c) = au + av = a(u+v)• Thus a divides b+c. • M. Hauskrecht CS 441 Discrete mathematics for CS

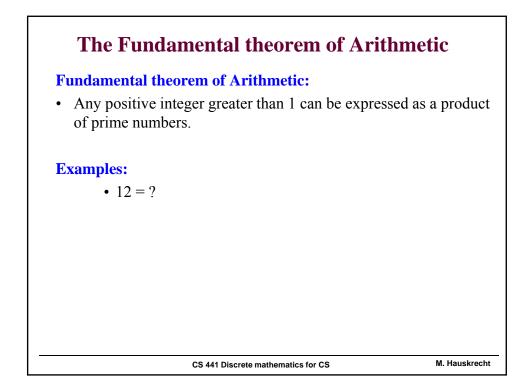
Divisibility						
Properties:						
• Let a, b, c be integers. Then the following hold:						
1. if $a \mid b$ and $a \mid c$ then $a \mid (b + c)$						
2. if a b then a bc for all integers c						
3. if $a \mid b$ and $b \mid c$ then $a \mid c$						
 Proof of 2: if a b then a bc for all integers c If a b, then there is some integer u such that b = au. Multiplying both sides by c gives us bc = auc, so by c a bc. Thus a divides bc. 	lefinition,					
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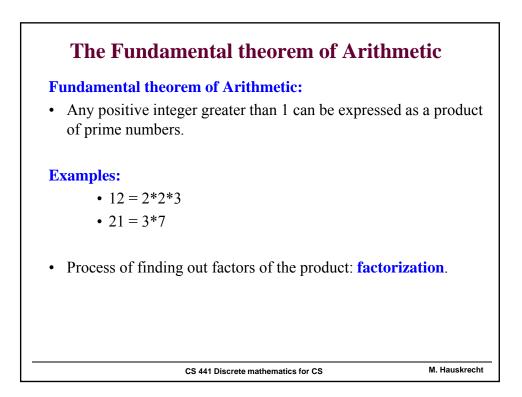


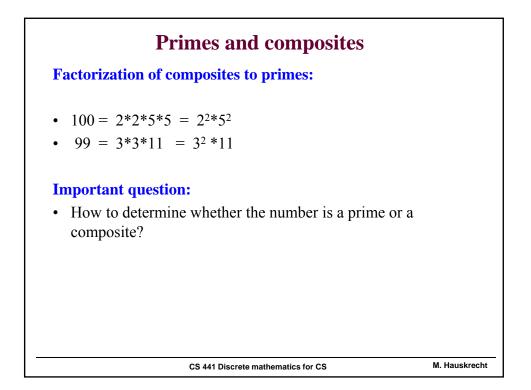


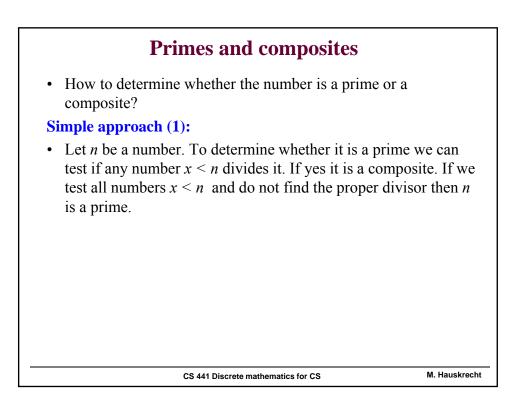












Primes and composites

• How to determine whether the number is a prime or a composite?

Simple approach (1):

• Let *n* be a number. To determine whether it is a prime we can test if any number *x* < *n* divides it. If yes it is a composite. If we test all numbers *x* < *n* and do not find the proper divisor then *n* is a prime.

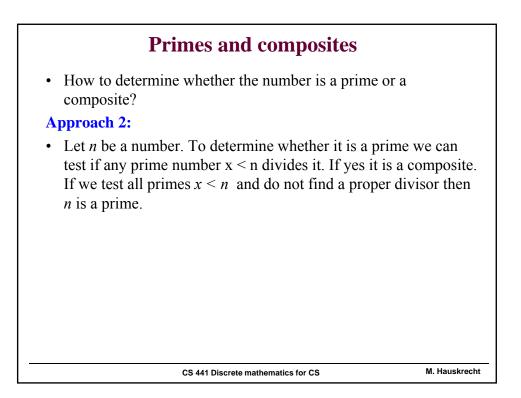
• Example:

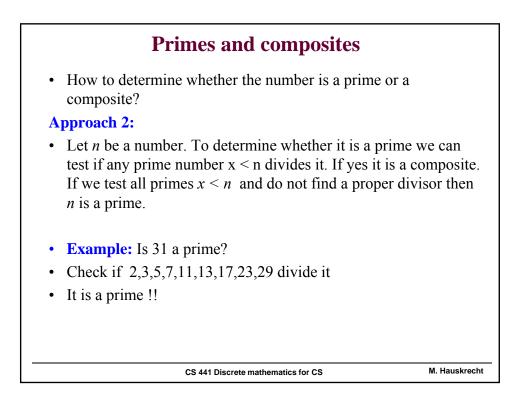
- Assume we want to check if 17 is a prime?
- The approach would require us to check:
- 2,3,4,5,6,7,8,9,10,11,12,13,14,15,16

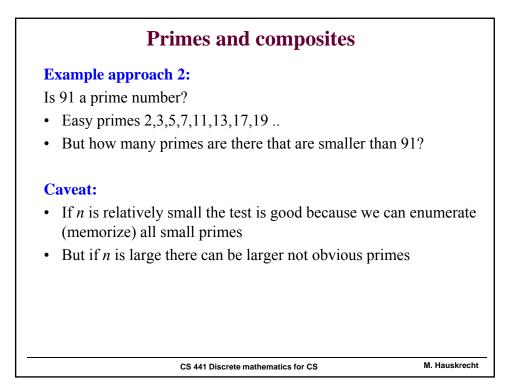
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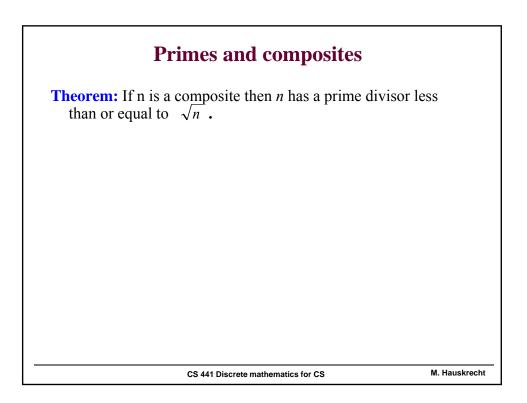
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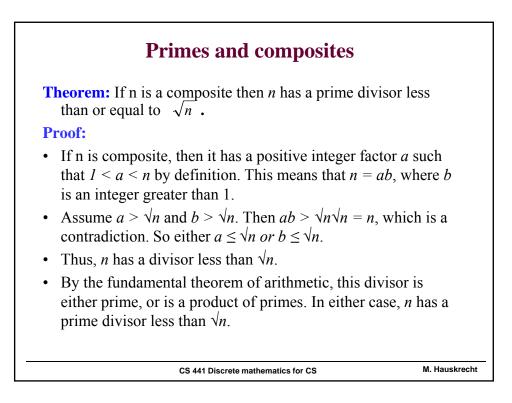
Primes and composites Example approach 1: Assume we want to check if 17 is a prime? The approach would require us to check: 2,3,4,5,6,7,8,9,10,11,12,13,14,15,16 Is this the best we can do? No. The problem here is that we try to test all the numbers. But this is not necessary. Idea: Every composite factorizes to a product of primes. So it is sufficient to test only the primes x < n to determine the primality of n.



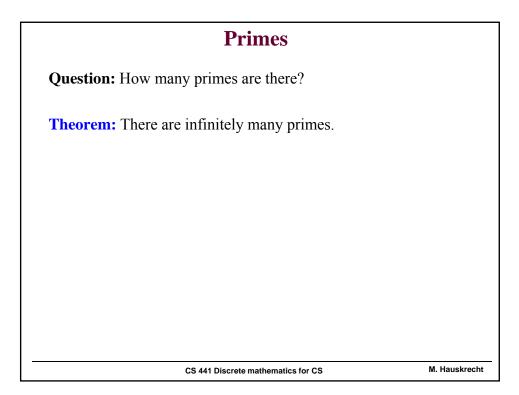


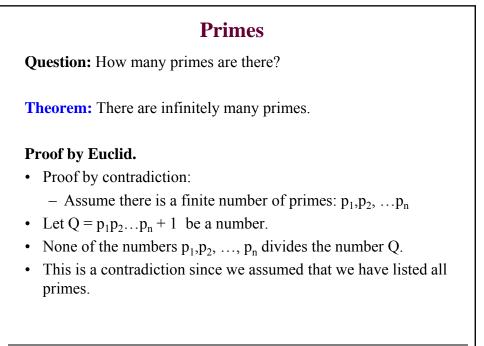






Primes and composites				
Theorem: If n is a composite that n has a prime divisor less than or equal to \sqrt{n} .				
Approach 3:				
• Let <i>n</i> be a number. To determine whether it is a prime we can test if any prime number $x < \sqrt{n}$ divides it.				
Example 1: Is 101 a prime?				
• Primes smaller than $\sqrt{101} = 10.xxx$ are: 2,3,5,7				
• 101 is not divisible by any of them				
Thus 101 is a prime				
Example 2: Is 91 a prime?				
• Primes smaller than $\sqrt{91}$ are: 2,3,5,7				
• 91 is divisible by 7				
Thus 91 is a composite				
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