MATH 4: ASSIGNMENT 4
OCTOBER 6, 2019
Topics discussed in class

Prime numbers: a number is called prime if it has no divisors other than itself and one. Other-wise, a number is called **composite.** (**Number 1 is an exception**: even though it has no divisors**, it is not considered prime nor a composite**).

Examples: numbers 2, 3, 5, 11, 19 are primes; number 42 is composite (because $42 = 6 \times 7$, so it has divisors 6, 7.) Any number can be written as a product of several primes: if it is not prime, it can be written as a product of two smaller numbers, then we can repeat the same with these numbers. E.g.: $42 = 6 \times 7 = 2 \times 3 \times 7$.

Another method of finding prime factorization is a tree method: https://www.youtube.com/watch?v=XWq8bplP-_E

To check whether a given number is prime or not, you have to try dividing it by all numbers smaller than itself: by 2, by 3, . . . In fact, it suffices to try dividing it only by primes. To quickly find all prime numbers, say, between 1 and 100, we can use method called Sieve of Eratosthenes. Write all numbers $1 - 100$, then cross out all multiples of 2, then all multiples of 3, then all multiples of 5 (there is no need to cross out multiples of 4 - since $4 = 2 \times 2$, every number which is a multiple of 4 is also a multiple of 2), and so on. In fact, it suffices to cross out only multiples of numbers up to 10.

http://en.wikipedia.org/wiki/Sieve_of_Eratosthenes

To quickly find all prime numbers, say, between 1 and 100, we can use method called **Sieve of Eratosthenes**.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
26	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
26	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**
101	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**	**121**	**122**	**123**	**124**	**125**
126	**127**	**128**	**129**	**130**	**131**	**132**	**133**	**134**	**135**	**136**	**137**	**138**	**139**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**147**	**148**	**149**	**150**
151	**152**	**153**	**154**	**155**	**156**	**157**	**158**	**159**	**160**	**161**	**162**	**163**	**164**	**165**	**166**	**167**	**168**	**169**	**170**	**171**	**172**	**173**	**174**	**175**
176	**177**	**178**	**179**	**180**	**181**	**182**	**183**	**184**	**185**	**186**	**187**	**188**	**189**	**190**	**191**	**192**	**193**	**194**	**195**	**196**	**197**	**198**	**199**	**200**

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HOMEWORK

1.
   a. Using the Sieve of Eratosthenes, try to find all primes between 1-200. [You only need to cross out multiples of numbers up to 13.] For your convenience, list is included.
   b. Find all pairs of prime numbers that differ by 2 – so called twins (such as 3 and 5, 5 and 7,. . .)

2. Write each of the numbers below as a product of primes. Here is a popular way of doing it: https://www.youtube.com/watch?v=XWq8bplP-_E

(a) 126; (b) 520; (c) 192; (d) 204; (e) 108; (f) 372

3.
   a. Write as a product of primes the following numbers: 1001; 2002; 24024 [*Hint: it is divisible by 24*].
   b. * Jane claims that if you take any two-digit number, write a zero after it, and then write the number again so you get a 5-digit number (for example, if your original number is 24, then you get 24024), then the result will always be a multiple of 7. Is she right? Can you explain why?

4. Among all numbers between 1 and 100, find out how many are
   (a) multiples of 6
   (b) multiples of 4
   (c) multiples of both 6 and 4
   (d) * not divisible by either 6 or 4

5. At a bus stop, there are three bus lines. One of them has buses running every 3 minutes, the other every 5 minutes, and the third one, every 7 minutes. A passenger noticed that at noon, the buses for all three lines meet at the stop. When will the same thing happen next time?

6.
   a. Find LCM and GCD of 196 and 21 by listing each number's multiples
   b. Write prime factorization of 196 and 21

7. A person takes a sheet of paper, then tears it into 4 pieces; then he picks up one of the pieces and tears it into 4, and so on. Do you think he will ever get exactly 200 pieces?