

1. This week's Problem of the Week in Math is described as follows:

There are thirty positive integers less than 100 that share a certain property. Your friend, Blake, wrote them down in the table to the left. But Blake made a mistake! One of the numbers listed is wrong and should be replaced with another. Which number is incorrect, what should it be replaced with, and why?

The numbers are listed below.

6	10	14	15	21
22	26	33	34	35
38	39	46	51	55
57	58	62	65	69
75	77	82	85	86
87	91	93	94	95

Use the fact that the “certain” property is that these numbers are all supposed to be the product of *unique* prime numbers to find and fix the mistake that Blake made.

Reminder: Code your solution in an R script and copy it over to this `.Rnw` file.

Hint: You may find the `%in%` operator and the `setdiff()` function to be helpful.

Solution:

```
#Vector of primes to iterate through
prime.list = c(2, 3, 5, 7, 11,
               13, 17, 19, 23, 29,
               31, 37, 41, 43, 47,
               53, 59, 61, 67, 71,
               73, 79, 83, 89, 97)

#Vector of numbers we have to check
nums.to.check = c(6, 10, 14, 15, 21,
                  22, 26, 33, 34, 35,
                  38, 39, 46, 51, 55,
                  57, 58, 62, 65, 69,
                  75, 77, 82, 85, 86,
                  87, 91, 93, 94, 95)

#Iterates through the list of numbers and checks if it has a prime factor.
#If it does, then it will check if the corresponding factor is also prime.
#If not, then the number is the outlier and gives us a vector of numbers
#where the real number will be.

for(i in 1:length(nums.to.check)){
  for(prime in prime.list){
    if(nums.to.check[i] %% prime == 0){
      products = prime * prime.list[-which(prime.list == prime)]
      if(!(nums.to.check[i] %in% products)){
        outlier = nums.to.check[i]
        possible.fixes = c((nums.to.check[i-1] + 1):((nums.to.check[i+1] - 1)))
      }
    }
  }
}

#Iterates through the numbers in possible.fixes to find the number
#with a product of unique prime numbers.

for(num in possible.fixes){
  for(prime in prime.list){
    if(num %% prime == 0){
      products = prime * prime.list
      if((num %in% products) & (!(num %in% nums.to.check))){
        fix = num
      }
    }
  }
}

display.ans = paste("The outlier number is:", outlier)
display.ans2 = paste("The real number is:", fix)
```

```
print(display.ans)
```

```
[1] "The outlier number is: 75"
```

```
print(display.ans2)
```

```
[1] "The real number is: 74"
```