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:

```
#Stores data frame values
initial.vals = c(6, 22, 38, 57, 75, 87, 10, 26, 39, 58, 77, 91, 14, 33, 46, 62, 82, 93, 15, 34, 51, 65, 85, 94,
                 21, 35, 55, 69, 86, 95)
correct.vals = vector(mode = "numeric", length = 0)
#Vector of all prime numbers less than 50
prime.numbers = c(2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37,
41, 43, 47)
product.range = 1:100 #Range of numbers where the product would be valid
#Finds every possible product of prime numbers that is less than 100
#Iterates through first factors
for(factor1 in prime.numbers)
{
  product = 0 #Stores product of two potential factors
  for(factor2 in prime.numbers)
  {
    if(factor1 != factor2)
    {
      product = factor1*factor2
      #Determines whether the product is within accepted range
      if(product %in% product.range)
      {
        correct.vals = append(correct.vals, product)
      }
    }
  }
}
diff.num = setdiff(initial.vals, correct.vals) #Stores the incorrect number
correct.num = setdiff(correct.vals, initial.vals) #Stores the correct number
answer = paste("Issue fixed: Blake inserted ", diff.num, "instead of ", correct.num)
print(answer)
```

```
## [1] "Issue fixed: Blake inserted  75 instead of  74"
```

```
justification = paste("Justification: My code found every possible product from 0 to 100 of unique prime numbers. 75 was not", "included in
#Used cat to make line breaks in string
cat(justification)
```

```
## Justification: My code found every possible product from 0 to 100 of unique prime numbers. 75 was not
## included in that which means that it cannot be the product of two unique prime numbers(this makes sense
## because 25*3 = 75 and 25 is not prime). The only number that the intitial list was missing from the correctly
## calculated list was 74 which means that Blake mistakenly replaced 74 with 75.
```