Assignment 2

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Question 1

makeSet = n
union = $m - c$
find = $4m - 2c + n$

makeSet is for every person in set S so it is called n times.

union is called at least m times, but we have to subtract the connected components

find is called twice for each pair to check if they are in the same component and then another two times in union. It is finally called again n times at the end of the algorithm to output each persons connected components

Question 2

$size \leftarrow n - 1$
$left \leftarrow 0$
while $left \leq size$ **do**
  while $A[left]\%2 = 0$ **do**
    $left + +$
  end while
  while $A[size]\%2 = 1$ **do**
    $right - -$
  end while
  $temp = A[left]$
  $A[left] = A[size]$
  $A[SIZE] = A[LEFT]$

Question 3

First create n empty buckets for all n integers, then for every element in the array insert $A[i]$ into the $Bucket[A[i]]$. Sort each bucket using insertion sort then concatenate the sorted buckets. This results in an O(n) sorting algorithm

Question 4

C-10.8
see below, because there is a globally optimal solution this method is disproved since the one below is more optimal.
C-10.9

Suppose there is some strategy that is more optimal
Let it be represented by O = (m_k, s_j) Let our greedy solution be represented
by G (m_i, s_i)
then,
$m_i - s_i > m_k - sj$

Question 5

The recurrence time of the algorithm is $T(n) = 3T(\frac{2}{3}) + 1$
Since $log_{\frac{2}{3}}3 = 2.70$
and $1 < 2.70$
using the master theorem this is case 1
so,
O(n$^{2.70}$)

Question 6

```
mergesort(A)
l = 0
r = A.size
while l ¡ r do
  if A[l] + A[r] = sum then
    return1
  else if A[l] + A[r] < sum then
    l + +
  else
    l − −
  end while
```

Question 7

Edit Distance	English	Italian	Spanish	Portuguese
English	0	105	99	97
Italian	x	0	87	93
Spanish	x	x	0	70
Portuguese	x	x	x	0

optimal alignment:

```
ACATACGATACAGACGATCGGCTAGAATCCACCAGCTACAGCTAG-T-C---GATACA-G
|||||||||||  | ||  |||||||||||||||||||||||||| | |   ||| | |
ACATACGATAC--A-GA--GGCTAGAATCCACCAGCTACAGCTAGTTACAAGGATCGATG

CACGAATCGCTAAACAG-CTCGATCGATCGCTAGCTGATCGATACTTACCACAGCTGATC
```

```
       ||||||     |||||||| || | |     ||||||||||||||||||||||||||||| |
CACGAA---CTAAACAGACTAG-TTTCTCGCTAGCTGATCGATACTTACCACAGCTAAAA


GATGCTATT-TAGCTAGCT-CGTAGTA
||||||||| | |  ||||    |  ||
GATGCTATTATTG-GAGCTAATTTTTA


edit distance = 34




optimal alignment:

once upon- -a time
|| || ||| |  | | |
on-e -pony is mine

edit distance = 7




optimal alignment:

I can't remember if I cried When I read a-bout -his- --wi-do
 |     |||     || |   | | |   | | | ||     |   | |   |
o puedo recordar si llor-e- Cuando le-i acerca de su novia q


we-d-- b--ri-de -But --so-me-t---hing touched me deep inside
 | |   |  | | |     | |  | || |        |       | ||   | |
ue dejaba viuda Pero algo me toco muy profundame-nte- El dia


 The day the music- -died
|  || |      ||||||| |
 que la----- musica murio


edit distance = 99
```