Algorithms - Assignment 1

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Πρόβλημα 1

- Ερώτημα 1

```
1 function MajorityFinder(A[1...n])
2  majority_person = []
3  maxcount = 0
4  count
5  temp
6  for(i = 1 to n)
7          count = 0
8          temp = A[i]
9          for(j = 1 to n)
10                 if(temp = = A[j])
11                         count++
12         if(count > maxcount)
13                 maxcount = count
14                 majority_person[1] = temp
15                 majority_person[2] = null
16         else if(count = = maxcount)
17                 majority_person[2] = temp
18 if(maxcount ≥ ⌈n/2⌉)
19         return majority_person
20 else
21         return "no person has the majority"
```

- Ερώτημα 2

Merge Sort

```
1 function mergesort(a[1...n])
2  if(n > 1)
3          return merge(mergesort(a[1...⌊n/2⌋]), mergesort(a[⌊n/2⌋ + 1 ...n]))
4  else
5          return a

1 function merge(x[1...k], y[1...l])
2  if(k = 0)
3          return y[1...l]
4  if(l = 0)
5          return x[1...l]
6  if(x[1] ≥ y[1])
7          return x[1] ∘ merge(x[2...k], y[1...l])
8  else
9          return y[1] ∘ merge(x[1...k], y[2...l])
```

```
1 function MajorityFinder2(A[1...n])
2  majority_person = []
3  mergesort(A)
4  for(i = 1 to n)
5          if(A[i] == A[⌈n/2⌉ - 1 + i])
6                  if(majority_person[1] == null)
7                          majority_person[1] = A[i]
8                  else
9                          majority_person[2] = A[i]
10 return majority_person
```

- Ερώτημα 3

```
1 function MajorityFinder3(A[1...n])
2  majority_person = []
3  HashMap T
4  for(i = 1 to n)
5          if(T.search(A[i]) == true)
6                  T[A[i]] = T[A[i]] + 1
7          else
8                  T.put([A[i], 1)
9          if(T[A[i]] ≥ ⌈n/2⌉)
10                 if(majority_person[1] == null)
11                         majority_person[1] = A[i]
12                 else
13                         majority_person[2] = A[i]
14 return majority_person
```

Πρόβλημα 2

- Ερώτημα 1

Algorithm 1

Έστω πίνακας T με στοιχεία n θετικούς ακεραίους με εύρος [0,...,k] (k ακέραιος)

```
1  for i = 0,...,k do
2          H[i] = 0
3  end for
4  for j = 1,...,n do
5          H[T[j]] = H[T[j]] + 1
6  end for
7  for i = 1,...,k do
8          H[i] = H[i] + H[i - 1]
9  end for
10 for j = n,...,1 do
11         S[H[T[j]]] = T[j]
12         H[T[j]] = H[T[j]] -1
13 end for
```

- Ερώτημα 2