Technische Universität München
Fakultät für Informatik
Lehrstuhl für Effiziente Algorithmen
Sandeep Sadanandan

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Solution Sheet 1
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Python For Fine Programmers

Problem 1 (6 Points)

Tower of Hanoi: Write a program to solve the problem of tower of Hanoi. The disks could be represented as numbers where a larger number represents are larger disc; and the needles could be three positions in a LIST.

Solution

```
1
2
3  def movedisc(s, d):
4    d.append(s.pop())
5
6  def myprint():
7    print msrc, mdst, mtmp
8
9  def toh(src, dst, tmp, n):
10   if n == 1:
11     movedisc(src, dst)
12     return
13   toh(src, tmp, dst, n-1)
14   movedisc(src, dst)
15   toh(tmp, dst, src, n-1)
16
17
18 msrc = [ i*'-' for i in range(1, 4)]
19 mdst = []
20 mtmp = []
21
22 toh(msrc, mdst, mtmp, len(msrc))
```

Problem 2 (8 Points)

Implement Bubblesort and Binary Search (One could read the numbers into a List and then do the sorting)

Solution

```
1
2
3  def bubblesort(arr):
4    for i in range(len(arr)-1, 0, -1):
5      for j in range(i):
6        if arr[j] > arr[j+1]:
```

```
7           arr[j], arr[j+1] = arr[j+1], arr[j]
8
9   def binsearch(ele, arr):
10    low, high = 0, len(arr)-1
11
12    while low < high:
13      mid = (low + high) / 2
14      if ele < arr[mid]:
15        high = mid - 1
16      elif ele > arr[mid]:
17        low  = mid + 1
18      else:
19        return mid
20    return -1
21
22
23
24  import random
25  myarray = [random.randint(10, 1000) for i in range(30)]
26  print myarray
27  bubblesort(myarray)
28  print myarray
29  print binsearch(49, myarray)
30  print binsearch(myarray[14], myarray)
```

Problem 3 (8 Points)

Number to Word Conversion Write two python functions, which converts a given integer to its word representation. The two functions differ as follows

1. The given number is written to the input each digit by digit. An input of "456" should print "four five six" to the screen.

2. The given number's value, in words, has to be printed to the screen. The input "456" should give an output "four hundred and fifty six". The input size may be limited to ten thousand.

Solution

```
1
2  numworddict    = {0:"zero", 1:"one", 2:"two", 3:"three", 4:"four",
3          5:"five", 6:"six", 7:"seven", 8:"eight", 9:"nine"}
4
5  numworddict100 = { 0 : "", 2 : "twenty", 3 : "thirty", 4 : "forty", 5 :
6          "fifty", 6 : "sixty", 7 : "seventy", 8 : "eighty", 9 :
7          "ninenty"}
8
9  numworddict1020 = { 10 : "ten", 11 : "eleven", 12 : "twelve", 13 :
10         "thirteen", 14 : "fourteen", 15 : "fifteen", 16 :
11         "sixteen", 17 : "seventeen", 18 : "eighteen", 19 :
12         "nineteen"}
```

```
13
14
15 def numtoword(inte):
16   if inte < 10:
17     print numworddict[inte],
18     return
19   numtoword(inte / 10)
20   print numworddict[inte%10],
21
22
23 def numtoword_str(str):
24   for i in str:
25     print numworddict[ord(i) - ord('0')],
26
27
28 def printthis(n, str):
29   if n:
30     return numworddict[n] + str
31   return ''
32
33
34 def writeinwords(num):
35   if num > 9999:
36     print "Not yet done"
37     return
38
39   printit = ''
40
41   printit += printthis(num/1000, " thousand ")
42   num %= 1000
43
44   printit += printthis(num/100, " hundred ")
45   num %= 100
46
47   if printit:
48     printit += 'and '
49
50   if num > 9 and num < 20:
51     printit += numworddict1020[num]
52   else:
53     printit += numworddict100[num/10] + printthis(num%10, '')
54
55   print printit
56
57
58
59 numtoword(158624856285)
60 print "\n"
61 numtoword_str('158624856285')
62 print "\n"
```

```
writeinwords(1234)
writeinwords(4)
writeinwords(234)
writeinwords(1204)
writeinwords(1214)
writeinwords(1210)
```

Problem 4 (4 Points)

Product of elements in an ARRAY. Write a program for the following.
There is a List $A[n]$ of n integers. You have to create another List $Output$ such that $Output[i]$ will be equal to the product of all the elements of A except $A[i]$.
Using a division operator is not permitted.

Solution

```
def arraywithproducts(A):
  op = [1 for i in range(len(A))]
  lp = rp = 1

  for i in range(len(A)):
    j = len(A) - 1 - i
    op[i] *= lp
    op[j] *= rp
    lp *= A[i]
    rp *= A[j]

  return op


array = [11, 23, 4, 9, 1]
print array
print arraywithproducts(array)
```