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Data Structures and Algorithms.
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Unit 4 – Recursion

Problem 1: Write a recursive method for finding the minimum element in a list of integers.

Solution:

```
def minimum(l):
    if l is None or len(l)==0:
        #print('list is empty')
        return None

    if len(l)==1:
        return l[0]
    else:
        return min(l[0],minimum(l[1:]))
```

Problem 2: Write a recursive method that determines if a string s is a palindrome, that is, it is equal to its reverse. For example, racecar and gohangasalamiimalasagnahog are palindromes.

Solution:

```
def checkPalindrome(s):
    if s is None or len(s)==0:
        #print('list is empty')
        return True
    n=len(s)-1
    return s[0]==s[n] and checkPalindrome(s[1:n])
```

Problem 3: Write a recursive method that takes an integer and returns the sum of its digits (for example, for n=2356, the method should return 2+3+5+6=16). Hint: 2356/10=235, 235/10=23, 23/10=2.

Solution:

```
def sumDigits(n):
    if type(n)!=int:
        print('n must be integer')
        return None
    if n<0:
        n=abs(n)
    if n<10:
        return n
    else:
        return n%10 + sumDigits(n//10)
```

Problem 4: Write a recursive method that takes a list of integers and checks if the list is sorted (ascending order). For example if a=[3,4,5,2], checkSort(a)=False, a=[3,4,5,7], checkSort(a)=True

Solution:

```
def isSorted(l):
    if l is None or len(l)<=1:
        return True

    if l[0]>l[1]:
        return False
    else:
        return isSorted(l[1:])

    #return l[0]<=l[1] and isSorted(l[1:])
```

Problem 5: Write a recursive method that takes two integers x and y and returns x times y by using the russian method. This russian method consists of :

1) Make two columns. Write the largest number in the first column, and the smallest in the second.

2) In the first column, divide the number by 2 repeatedly until to get to 1. In the second column, multiply the number by 2 until you have the same rows than in the first column.

3) Cross out the rows whose value in the first column is an even number (x % 2==0)

4) Add the values in the second columns. The result is the answer.

For example, 17*100=1700

17	100
8	200
4	400
2	800
1	1600

=1700

Solution:

```
def russianMult(a,b):
    if a==0 or b==0:
        return 0
    if a==1:
        return b
    if a%2==0:
        return russianMult(a//2,b*2)
    if a%2!=0:
        return b+russianMult(a//2,b*2)
```