Sample Midterm 3

(1) Design an NFA for the regular expression $(10)^{+} + 1(10)^{*}$.

(2) Find a recurrence for the total number of recursive calls in the following functions:

```
def funct(n):
      if n <= 3:
            return n
      else:
            return funct(n-1)-funct(n-2)+funct(n-3)
```

(3) Show that the following functions satisfies the loop invariant indicated in the comment

```
def max(A):
      answer = A[0]
      for j in range(1,len(A)):

            #LOOP INVARIANT: answer is the largest element in
            #A[0:j-1]

            if (A[j]>answer): answer = A[j]
      return answer
```

(4) Compare $\frac{n}{\log(n^2)}$ and $\sqrt{n}$ asymptotically.

(5) Apply the Master Theorem on $T(n) = 4T(n/3) + n$.