PART I:
ALGORITHM

1. Let X[1..n] and Y[1..n] be integer arrays, each sorted in nondecreasing order. Write an O(log n) algorithm that finds the k_{th} smallest of the 2n combined elements, where $1 \leq k \leq n$.

2. If k is a nonnegative constant then the solution of the recurrence

$$T(n) = \begin{cases} k, & n=1 \\ 3T(n/2)+kn, & n > 1 \end{cases}$$

for n a power of 2 is $T(n) = 3 * k * n^{log_2 3} - 2 * k * n$.
Prove this statement.

3. True or False (defend your answer): the following nondeterministic algorithm solves the No Partion Problem in nondeterministic polynomial time.

```
S:={};
p:=1;
while p≤n do
    q:=select({0,1})
    if q=1 then
        S:= SU{p}
    endif
    p:=p+1;
endwhile
if
```

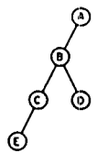
$$\sum_{i \in S} c_i \neq \sum_{i \notin S} c_i$$

```
then
        success, print("yes")
else
        failure, print("no")
endif
```

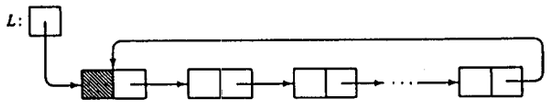
PART II

DATA STRUCTURE

1. Draw the internal memory representation of the following binary tree using (a) sequential, (b) linked, and (c) threaded linked representations. (15%)



2. Write a simple, nonrecursive algorithm to ***reverse*** a cicular list of the type in the following figure. (12%)



3. If $X=(x_1, x_2, ..., x_m)$ and $Y=(y_1, y_2, ..., y_n)$ are strings where x_i and y_j are letters of the alphabet, then X is less than Y if $x_i = y_i$ for $1 \le i < j$ and $x_j < y_j$ or if $x_i = y_i$ for $1 \le i \le m$ and $m < n$. Write an algorithm which takes two strings X, Y and returns either -1, 0, +1 if $X < Y$, $X = Y$ or $X > Y$ respectively. (12%)

4. In a given connected weighted graph G, suppose there exists an edge e_s whose weight is smaller than that of any other in G. Prove that every minimum cost spanning tree in G must contain e_s. (11%)