# EECS 477. HOMEWORK 5.

**Due on Tuesday 11/19/2002 before noon**
**in mailbox labeled 477 in room 2420 EECS**

**YOUR NAME:** _____

**You must show all work to receive credit!**

**Please read the statement below and sign your name; otherwise, your homework will not be graded.** The text of the College of Engineering's Honor Code can be found at http://honor.personal.engin.umich.edu/

I hereby acknowledge that I understand the College of Engineering's Honor Code and have pledged to uphold it and abide by it.

Signature: _____

## 1. Selection with pseudomedian (20pts)

In this problem we ask you to perform analysis of the selection algorithm. We know that when the chunk size 5 is used, the runtime of the algorithm in the worst case is $\Theta(n)$ where $n$ is the size of the input array. Replicate the analysis of section 7.5 as much as you can when the chunk size is equal to 3. Repeat with the chunk size equal to 7. What is the worst runtime asymptotics in these two cases?

You may use the following recursive version of the algorithm in your analysis.

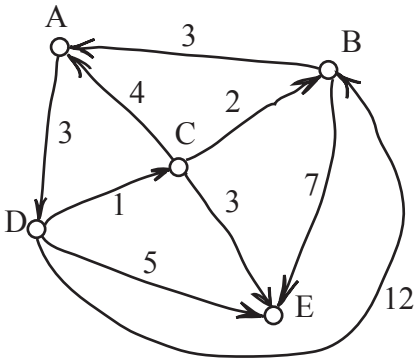
```
float rec_selection(A, i, j, s) {
    unsigned p = pseudo_median(A, i, j);
    pair<unsigned, unsigned> kl = pivot(A, i, j);
    unsigned k = kl.first, l = kl.second;
    if(s<=k)
        return rec_selection(A, i, k, s);
    else if(s>=l)
        return rec_selection(A, k, j, s);
    else
        return p;
}
```

```
float pseudo_median(A, i, j) {
    unsigned n = j-i+1; // num of elements in the range
    if(n<=CHUNK_SIZE)
        return adhoc_median(A, i, j);
    unsigned nz = n/5+1;
    vector<float> Z(nz);
    for(int k=0; k<nz; ++k)
        Z[k] = adhoc_median(A, i + 5*k, i+5*k+4);
    return rec_selection(Z, nz/2);
}
```

## 2. Knapsack (20pts)

Solve problem 9.54 from the book.

## 3. Floyd's algorithm (20pts)



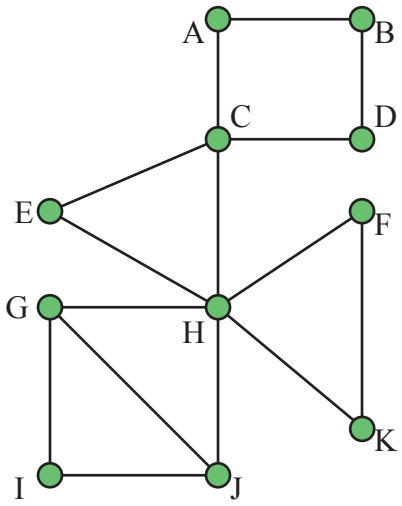

For the directed graph above compute the matrix of shortest path distances using Floyd's method; show all the intermediate matrices.

## 4. Coins (20pts)

(A) Apply the dynamic programming algorithm to the problem of paying \$17 within the system of coinage with coins in denominations \$1, \$4, \$7 available. Fill the table, and get the answer.

(B) Write pseudocode for the recursive version of dynamic programming coin payment algorithm that uses a memory function.

## 5. DFS(20pts)




For the graph above perform depth-first search starting with vertex A and draw the corresponding spanning tree (together with the remaining graph edges as dashed lines). Index the graph nodes as in preorder traversal. Find the highest index for every vertex as defined in the book (page 297). Find the articulation points using criteria from the book.

## 6. EXTRA 20 pts

Do problem 7.38 from the book.