1. Using Huffman's algorithm, construct an optimal prefix code for the six-letter alphabet {A,B,C,D,E,F} where frequencies are given in the following table.

A	1
B	2
C	3
D	4
E	5
F	6

2. Here is a C++ implementation of binary tree, where the data are of type integer:

```
struct binarytree {
   int item;
   binarytree *left;
   binarytree *right;
}
```

Write a recursive procedure which prints the items of a binary tree in inorder. If you write more than six lines of code (not counting lines that have only a comment or a single brace) you have written too much.

3. One of the first sorting algorithms we learned was selection sort, which takes $\Theta(n^2)$ time. The code for selection sort includes an outer loop and an inner loop. Write the loop invariant for the outer loop.

4. You are building a cuckoo hash table for the following data set consisting of 8 items. The indices of your has table are $\{0, 1, \ldots 9\}$. The two hash values for each item are listed in the first and second columns of the array below.

   Walk through the steps of inserting the items, in the order given in the array.

Ann	1	4
Dan	8	7
Kim	2	8
Sam	5	2
Zoe	3	9
Ted	5	0
Kat	8	2
Max	3	4

5. State the asymptotic complexity of each of the following code fragments in terms of n, where n is a positive integer. Use Θ notation.

(a)
```
for (int i = 0; i < n; i++)
    cout << "Hello world" << endl;
```

(b)
```
for(int i=1; i<n; i++)
    for(int j=i; j<n; j++)
      cout << "Hello world" << endl;
```

(c)
```
for(int i=0; i<n; i++)
    for(int j=n+1; j>i; j=j-2)
      cout << "Hello world" << endl;
```

(d)
```
for(int i=1; i<n; i++)
    for(int j=0; j*j<i; j++)
      cout << "Hello world" << endl;
```

(e)
```
for (int i = 0; i < n; i = 2*i+1)
    cout << "Hello world" << endl;
```

(f)
```
for (int i = 0; i < n; i++)
    for (int j = i; j > 0; j = j/2);
      cout << "Hello world" << endl;
```

(g)
```
for (int i = 0; i < n; i++)
    for (int j = n; j > i/2; j = j/2);
      cout << "Hello world" << endl;
```

(h)
```
for (int i = 0; i < n; i = i*i+1)
    cout << "Hello world" << endl;
```

(i)
```
for(int i=1; i<n; i++)
    for(int j=i; j>1; j=j/2)
      cout << "Hello world" << endl;
```

(j)
```
for(int i=1; i<n; i++)
    for(int j=i; j<n*n; j=j+j)
      cout << "Hello world" << endl;
```

(k)
```
int m = 1;
for(int i=1; i<n; i++)
  {
   m = 2*m;
   for(int j=1; j<m; j++)
     cout << "Hello world" << endl;
  }
```