

EEN318
First Test
25th October 2010

No Singing or Dancing Permitted.

Who are you ?

What is your student number?

“I have neither given nor accepted any aid in this examination”: Sign

Make no marks in these boxes				
Question	1	2	3	4
Value	33%	33%	33%	1%
Score				

1.

Here are five attempts to define a hash function:

A.

```
int hashfn_A(string s)
{ int h=13;
  for (int i=0; i<s.length(); i+=1)
    h += s[i];
  if (h<0)
    { h = -h;
      if (h<0)
        h = 27341; }
  return h; }
```

B.

```
int hashfn_B(string s)
{ int h=1234;
  for (int i=0; i<s.length(); i+=1)
    h *= s[i];
  if (h<0)
    { h = -h;
      if (h<0)
        h = 1357; }
  return h; }
```

C.

```
int hashfn_C(string s)
{ int h=12345;
  for (int i=0; i<s.length(); i+=1)
    h = h*169 + s[i];
  if (h<0)
    { h = -h;
      if (h<0)
        h = 83674; }
  return h; }
```

D.

```
int hashfn_D(string s)
{ int h=12345;
  for (int i=0; i<s.length(); i+=1)
    h = h*237 + s[i];
  if (h<0)
    { h = -h;
      if (h<0)
        h = random(); }
  return h; }
```

E.

```
int hashfn_E(string s)
{ int h=12345;
  for (int i=0; i<s.length(); i+=1)
    h = h*256 + s[i];
  if (h<0)
    { h = -h;
      if (h<0)
        h = 673671; }
  return h; }
```

(Question continued over...)

A to E.

Some of these hash functions may be very good, some may be very bad. Examine them all, and for each that is imperfect, say exactly what is wrong with it, and what problems it would cause. If any are perfect, say which.

F.

Every one of those hash functions includes four lines of this nature:

```
if (h<0)
{ h = -h;
  if (h<0)
    h = .....; }
```

Explain exactly why that section of code is there. Take care to explain the purpose of both `ifs`.

2.

Explain the Quicksort algorithm in sufficient detail that a competent programmer reading your description could program it.

3.

Given that somebody has already defined the required structs to represent a road map as a graph, like this:

```
struct town
{ string name;
  int distance;
  roadlink * roads; }

struct roadlink
{ int length;
  town * whereto;
  roadlink * next; }
```

As you can see, the programmer chose not to give each town a vector for the roads that lead from it, but a linked list instead. Each `roadlink` records the length of a road leading from the current town, and the town that it leads to. The programmer has even written the code that correctly constructs the graph.

What you have to do is write the code that will find the length of the shortest path between two towns.

Write a function

```
int shortest(town * A, town * B)
```

that performs this task. Of

course you may define any other functions or data structures that will make the job easier.

4.

Draw a picture of a cat on a chair.