COS126: General Computer Science	Spring 1996

Second Midterm Exam

Date: Thursday, April 4, 1996

Instructions: *This exam is open-book. You may use your personal notes, any handouts and lecture notes from this course, the course reader, and "The C Programming Language" by Kernighan and Ritchie.* **No other materials are allowed.** *You have 90 minutes for this exam. There are three problems, some of which consist of more than one part. Write all your answers in an exam booklet. Show your work so that we can give you partial credit in case your final answer is wrong.*

Be sure that your name and precept number are on the front of the booklet and printed legibly. Write and sign the honor code pledge.

Problem 1, 30 points:

1. (*15 points*) Identify all syntax errors in the following program. Copy the offending lines in your answerbook and briefly explain for each why it is an error. (You will be penalized if you identify non-errors as errors.)

```
#include <stdio.h>
#include <stdlib.h>
struct CS126 {int C; struct CS126 *rest};
struct course {struct CS126 good;};
struct course test(struct CS126 y)
{
 struct course *new;
 y.rest = y.C;
 new =malloc(sizeof(course));
 new.good =y;
 return new;
}
void main()
{
 struct CS126 x;
 test(&x);
}
```

2. (*15 points*) What does the following program print?

```
#include <stdio.h>
void f(int *x)
{
 if (*x >0)
  {
   *x = *x -1;
   f(x);
  }

}
void main()
{ int x= 4;
  f(&x);
  printf(``%d'', x);
}
```

Problem 2, 35 points: Let (x_1, y_1) and (x_2, y_2) be two *pairs* of integers. We say that (x_1, y_1) is *less than* (x_2, y_2) if either $x_1 < x_2$ or

$$x_1 = x_2 \text{ and } y_1 < y_2.$$

For example $(2, 4)$ is less than $(4, 2)$ since $2 < 4$. Similarly, $(2, 4)$ is less than $(2, 5)$ since $2 = 2$ and $4 < 5$.

Now suppose you are given a program that begins with the following lines.

```
#include <stdio.h>
#define N 10000
struct pair { int x; int y;};
struct pair A[N];
```

Write a function `sortA` with the declaration

```
void sortA();
```

that sorts the array A. At the end, the pair $A[i]$ should become less than the pair $A[i+1]$ for $i = 0, 1, \ldots, N-2$. (Note that A is initialized in some other function, and you don't need to worry about that.) You may use any sorting technique of your choice.

Problem 3, 35 points: Suppose the `node` and `list` structures are defined as in the lecture notes.

```
struct node {int value; struct node *next;};
struct list {struct node *head; struct node *tail;};
```

Write a function `everyother` with the declaration

```
struct list *everyother(struct list *li);
```

that takes a pointer to a list as its argument, creates a new list and copies every second element of the existing list into this new list. The value returned by the function should be a pointer to a newly created list.

Thus for example if `li` is a pointer to the list $\{5, 21, 32, 65, 2, 8, 15\}$ then the list created by the function would be $\{21, 65, 8\}$. However, the function should not destroy the first list while creating the second list.