Some CPSC 259 Sample Midterm and Final Exam Questions (Part 2)

1. {3 marks} Find the errors in the following code fragment. List each erroneous statement and briefly describe the error in it.

```
#define NUM   777

int main(void)
{
  int x = 10;
  int *p = NUM, *q = NULL;

  *p = x;
  x  = *q;
  &x = NUM;

  ...
}
```

2. {4 marks} Find the errors in the following function and give a brief explanation for each error.

```
/* Allocate an integer array of size MAXLEN, and initialize all
elements to zero.  Then, return a pointer (i.e., address) to
element [n] in the array, where 0 <= n <= MAXLEN (else return
NULL). */

int * makeArray(int n)
{
   int  a[MAXLEN];
   int  i;

   for (i = 0; i <= MAXLEN; i++)
        a[i] = 0;

   if (n >= 0  &&  n <= MAXLEN)
        return  a + n;

   return NULL;
}
```

3. {5 marks} Write a set of statements that creates a <u>dynamic</u> array of 100 integers, and sets all its element values to 100.

4. {5 marks} Suppose the nodes of a linked list structure are defined as follows:

```
struct node
{
   int              value;
   struct node *  next;
};
```

Define a function `length` which takes a pointer to the start of the linked list (of nodes) and returns the number of items that are in the list.

For instance, if `list` is the list (3, 9, 5, 6) then `length(list)` returns 4.

5. {8 marks} Suppose the nodes of a doubly linked list structure are defined as follows:

```
struct node
{
   int              item;
   struct node *  next;
   struct node *  prev;
};
```

Write a function `concat` which concatenates two given lists (the first node of the second list will follow the last node of the first list) and returns the new list. Note that `concat` does not create new nodes; it just rearranges the links of some existing notes. Assume that the pointers all refer to the head of their respective list.

```
struct node *  concat( struct node * list1, struct node * list2 )
{
```

6. {3 marks} Suppose that we use a linked list to represent a queue and that in addition to the `enqueue` and `dequeue` functions (i.e., functions to add and remove elements from the linked list), you want to add a new operation to the queue that deletes the last element of the queue. Which linked structure do we need to use to guarantee that this operation is also executed in constant time? Justify your answer.

7. {7 marks} Suppose you have a stack ADT (i.e., an Abstract Data Type that includes operations to maintain a stack).

   a) Describe in words (no code) how you could implement a queue's `enqueue` and `dequeue` operations using two stacks. Also, provide the Big-O complexity figures.

   b) Using this implementation, describe a linear time algorithm for reversing a queue.