MCS 360 Exercise Set #2

(to be turned in Tuesday, Sep 18, at the discussion section)

1. Consider the list in the handout *Linked Structures in C*. There are some operations that we cannot perform efficiently if the list is large. For example,

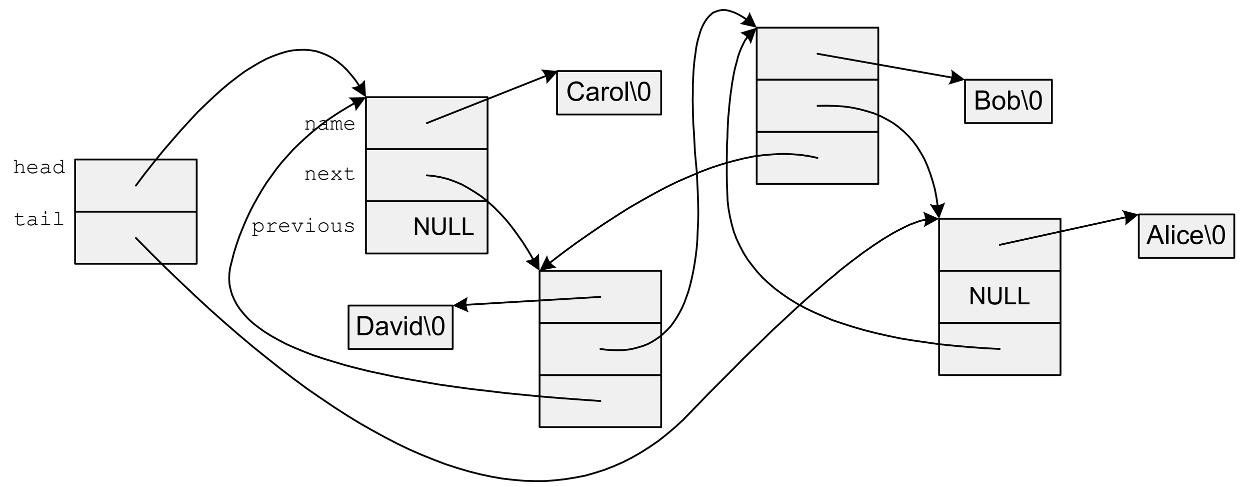
i) Print out the names in the list in reverse order.
ii) Given a pointer `p` to a node in the list, insert a new node *before* node `p`,
iii) Given a pointer `p` to a node in the list, delete node `p`.

We can perform each of these operations efficiently if we add one more field to our `Node` structure — a pointer to the previous node in the list (`NULL` for the first node). We will also need a pointer, call it `tail`, to the last node of the list, just as we already have a pointer `head` to the first node. It makes sense to place `head` and `tail` in a structure, say called `DList` (for doubly-linked list). The code in the handout and the example can be replaced by:

```
struct Node {
   char *name;
   struct Node *next;          /* Points to next node in list */
   struct Node *previous;      /* Points to previous node in list */
};
typedef struct Node Node;

Node *get_node( char *name, Node *next, Node *previous)
{
   Node *p = (Node *)checked_malloc(sizeof(Node));
   p->name = (char *)checked_malloc(strlen(name)+1));
   strcpy( p->name, name);
   p->next = next;
   p->previous = previous;
   return p;
}

struct DList {
   Node *head;            /* Points to first node in list */
   Node *tail;            /* Points to last node in list */
};
typedef struct DList DList;
```



Write C language code for

a) A function

```
void print_reverse( DList *list);
```

that will print the names in the list in reverse order.

b) A function

```
void insert_before( Node *p, char *name, DList *list);
```

that will insert a new node containing a copy of `name` before node `p` of `list`.

c) A function

```
void remove( Node *p, DList *list);
```

that will remove `Node p` from the list, and free it.

In each case above, you may assume that `list` points to a valid list structure, such as illustrated above. In (b) and (c), you may assume that `p` does point to some node in the list. The case in which this node is the first or last node may need special handling. You may use any functions from **`MCS360.c`**, or from the ANSI C library.

2. Do Exercise E1, parts (b) and (c), in the exercises for Section 3.1 (page 88)