College of Computer & Information Sciences

Computer Science Department

King Saud University
College of Computer and Information Sciences
Computer Science Department
CSC 215

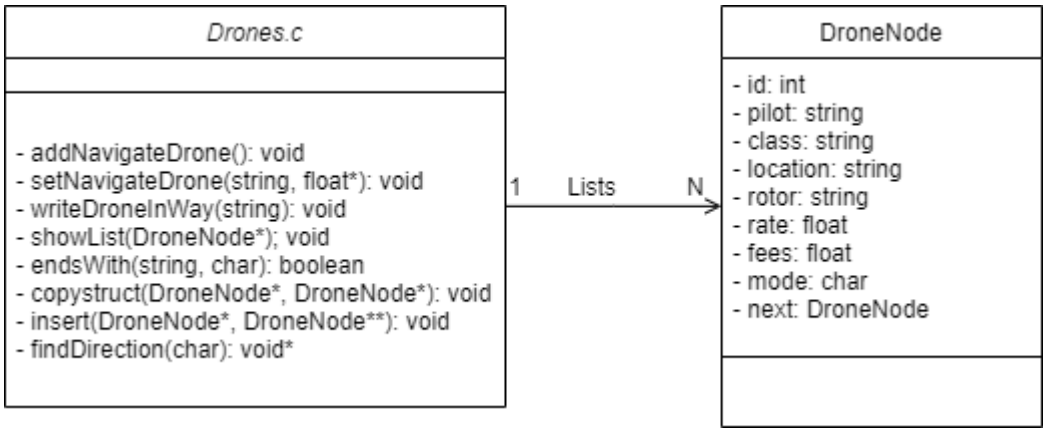
Drone navigation system

Student Name	Fatimah Alhumaidhi	Email	441200921@student.ksu.edu.sa

1- Introduction:

The main objective to the drone navigation system is to save data about the drones from a file to a dynamic linked list, applying all skills we learned through the the procedural programming with c course, from dealing with pointers and memory allocations to using structures and c libraries.

2- Problem Definition:



3 functions were added:

endsWith(string, char): compares the last character in a string with character d for direction, and makes sure that str is not null.

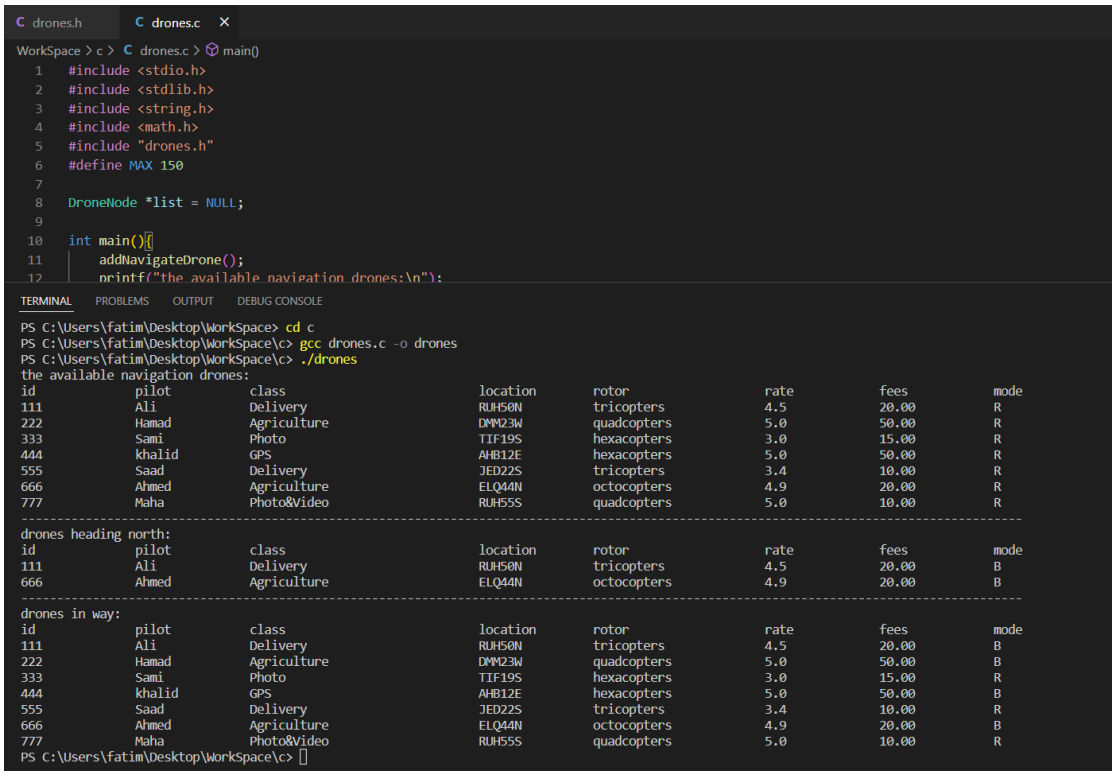
copystruct(DroneNode*, DroneNode*): copies drone information from a source node to a distenation node.

insert(DroneNode*, DroneNode**): inserts a node into sorted list in it's appropriate place depending on drone id.

All three functions were made to reduce the findDirection function, and make the code more redable.

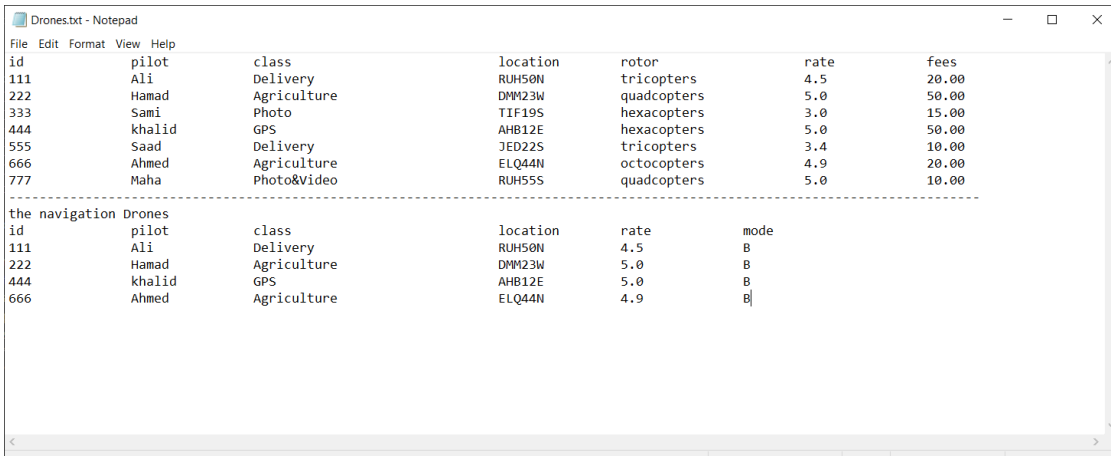
3- Test and Run:

I tested my code by printing each function's output on the console, first list tested addNavigateDrone and showList functions, the second tested setNavigateDrone and and findDrection, all outputs were as expected, here are screenshots of the results:



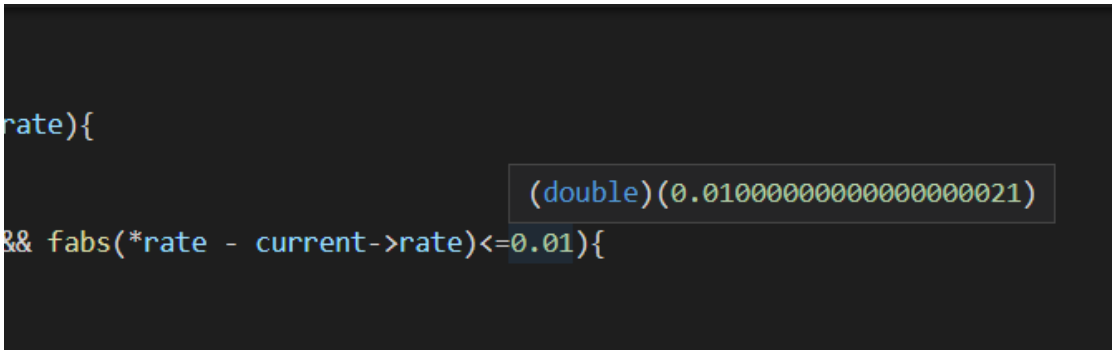
```
drones.h   drones.c
WorkSpace > c > drones.c > main()
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <math.h>
#include "drones.h"
#define MAX 150

DroneNode *list = NULL;

int main(){
    addNavigateDrone();
    printf("the available navigation drones:\n");

TERMINAL  PROBLEMS  OUTPUT  DEBUG CONSOLE
PS C:\Users\fatim\Desktop\WorkSpace> cd c
PS C:\Users\fatim\Desktop\WorkSpace\c> gcc drones.c -o drones
PS C:\Users\fatim\Desktop\WorkSpace\c> ./drones
the available navigation drones:
id          pilot       class                location    rotor          rate    fees    mode
111         Ali         Delivery             RUH50N      tricopters     4.5     20.00   R
222         Hamad       Agriculture          DMM23W      quadcopters    5.0     50.00   R
333         Sami        Photo                TIF19S      hexacopters    3.0     15.00   R
444         khalid      GPS                  AHB12E      hexacopters    5.0     50.00   R
555         Saad        Delivery             JED22S      tricopters     3.4     10.00   R
666         Ahmed       Agriculture          ELQ44N      octocopters    4.9     20.00   R
777         Maha        Photo&Video          RUH55S      quadcopters    5.0     10.00   R
-------------------------------------------------------------------------------------------------------------
drones heading north:
id          pilot       class                location    rotor          rate    fees    mode
111         Ali         Delivery             RUH50N      tricopters     4.5     20.00   B
666         Ahmed       Agriculture          ELQ44N      octocopters    4.9     20.00   B
-------------------------------------------------------------------------------------------------------------
drones in way:
id          pilot       class                location    rotor          rate    fees    mode
111         Ali         Delivery             RUH50N      tricopters     4.5     20.00   B
222         Hamad       Agriculture          DMM23W      quadcopters    5.0     50.00   B
333         Sami        Photo                TIF19S      hexacopters    3.0     15.00   R
444         khalid      GPS                  AHB12E      hexacopters    5.0     50.00   B
555         Saad        Delivery             JED22S      tricopters     3.4     10.00   R
666         Ahmed       Agriculture          ELQ44N      octocopters    4.9     20.00   B
777         Maha        Photo&Video          RUH55S      quadcopters    5.0     10.00   R
PS C:\Users\fatim\Desktop\WorkSpace\c>
```

And by checking the output in the text file I tested writeDroneInWay, which prints the drones with mode B:

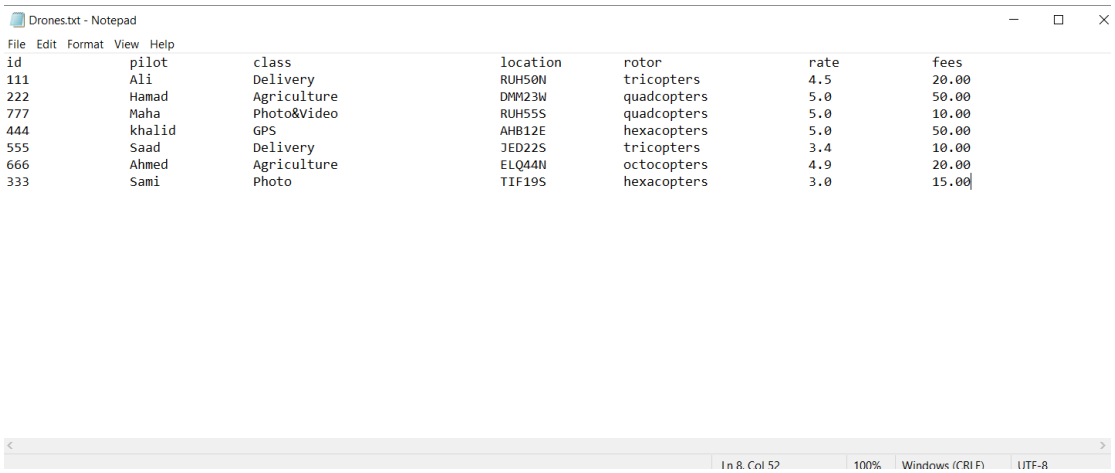


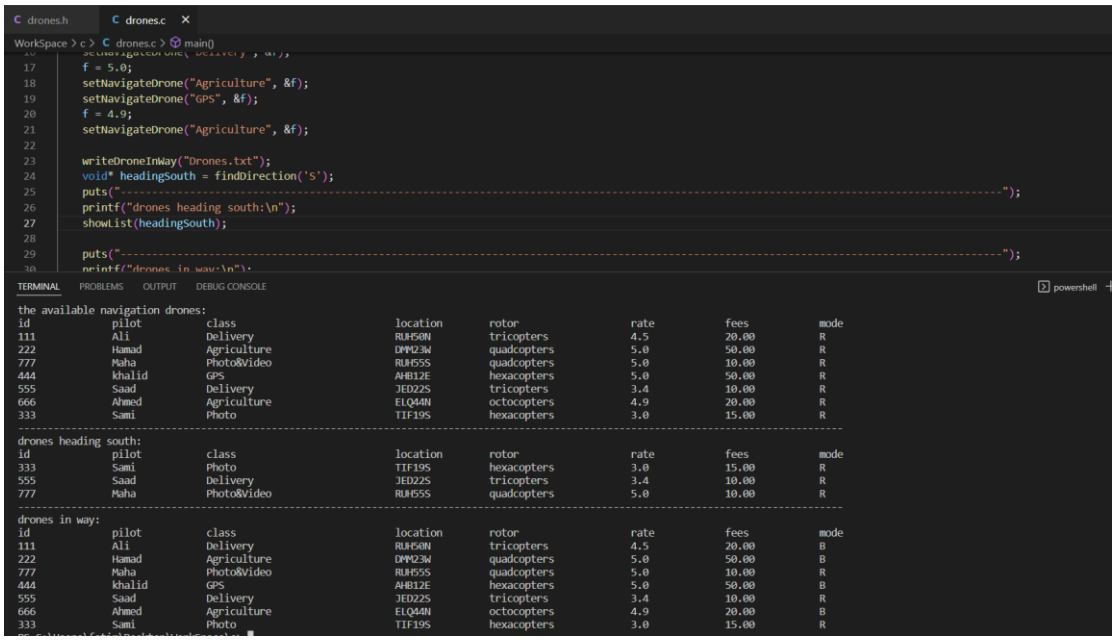
```
Drones.txt - Notepad
File  Edit  Format  View  Help
id          pilot       class                location    rotor          rate    fees
111         Ali         Delivery             RUH50N      tricopters     4.5     20.00
222         Hamad       Agriculture          DMM23W      quadcopters    5.0     50.00
333         Sami        Photo                TIF19S      hexacopters    3.0     15.00
444         khalid      GPS                  AHB12E      hexacopters    5.0     50.00
555         Saad        Delivery             JED22S      tricopters     3.4     10.00
666         Ahmed       Agriculture          ELQ44N      octocopters    4.9     20.00
777         Maha        Photo&Video          RUH55S      quadcopters    5.0     10.00
-------------------------------------------------------------------------------------------------------------
the navigation Drones
id          pilot       class                location    rate      mode
111         Ali         Delivery             RUH50N      4.5       B
222         Hamad       Agriculture          DMM23W      5.0       B
444         khalid      GPS                  AHB12E      5.0       B
666         Ahmed       Agriculture          ELQ44N      4.9       B
```

One problem I had was comparing equality of two floating point numbers, taking into account rounding error -showed in the picture-, which I solved easily by using the fabs() function found in the math.h library, which returns the absolute value of a number:



To make sure that the sorting and findDirection function work correctly, I reordered the information in Drones.txt file for drones heading south and tested the output, which also printed as expected:





4- Implementation:

Header file:

```
typedef struct Drone{
    int id;
    char pilot[20];
    char class[20];
    char location[8];
    char rotor[20];
    float rate;
    float fees;
    char mode;
    struct Drone* next;
}DroneNode; //project description specified not creating structures
other than struct Drone


void addNavigateDrone();
void setNavigateDrone(char*, float*);
void writeDroneInWay(char*);
void showList(DroneNode*);
void* findDirection(char);
```

c file:

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <math.h>
#include "drones.h"
#define MAX 150

DroneNode *list = NULL;

int main(){
    addNavigateDrone();
    printf("the available navigation drones:\n");
    showList(list);

    float f = 4.5;
    setNavigateDrone("Delivery", &f);
    f = 5.0;
    setNavigateDrone("Agriculture", &f);
```

```
    setNavigateDrone("GPS", &f);
    f = 4.9;
    setNavigateDrone("Agriculture", &f);

    writeDroneInWay("Drones.txt");
    void* headingNorth = findDirection('N');
    puts("------------------------------------------------------------
------------------------------------------------------------------------
--------");
    printf("drones heading north:\n");
    showList(headingNorth);

    puts("------------------------------------------------------------
------------------------------------------------------------------------
--------");
    printf("drones in way:\n");
    showList(list);
    return 0;
}

void addNavigateDrone(){
    DroneNode *current, *tail;
    FILE* file;
    if((file = fopen("Drones.txt", "r")) == NULL){
        exit(1);
    }
    char firstline[MAX];
    fgets(firstline, MAX, file);

    while(!feof(file)){
        if((current = (DroneNode*)malloc(sizeof(DroneNode))) == NULL){
            exit(1);
        }
        fscanf(file, "%d%s%s%s%s%f%f",  &current->id, current->pilot,
current->class, current->location, current->rotor, &current->rate,
&current->fees);
        current->mode = 'R';
        if(!list){
            tail = list = current;
        }
        else{
            tail->next = current;
            tail = tail->next;
        }
    }
    tail->next = NULL;
    fclose(file);
}
```

```
void setNavigateDrone(char* class, float* rate){
    DroneNode* current = list;
    while(current != NULL){
        if(!strcmp(current->class, class) && fabs(*rate - current-
>rate)<=0.01){
            current->mode = 'B';
        }
        current = current->next;
    }
}

void writeDroneInWay(char* fileName){

    FILE* file;
    if((file = fopen(fileName, "a")) == NULL){
        exit(1);
    }

    fputs("\n----------------------------------------------------------------
--------------------------------------------------------------------",
file);
    fputs("\nthe navigation Drones\n", file);
    fprintf(file, "%-16s%-16s%-32s%-16s%-16s%s\n", "id", "pilot",
"class", "location", "rate", "mode");
    DroneNode* current = list;
    while(current){
        if(current->mode == 'B'){
            fprintf(file, "%-16d%-16s%-32s%-16s%-16.1f%c\n",  current-
>id, current->pilot, current->class, current->location, current->rate,
current->mode);
        }
        current = current->next;
    }
    fclose(file);
}

void showList(DroneNode* list){
    if(list == NULL){
        printf("empty list.");
        exit(1);
    }
    printf("%-16s%-16s%-32s%-16s%-24s%-16s%-16s%s\n", "id", "pilot",
"class", "location", "rotor", "rate", "fees", "mode");
    DroneNode* current = list;
    while(current != NULL){
```

```
        printf("%-16d%-16s%-32s%-16s%-24s%-16.1f%-16.2f%c\n", current-
>id, current->pilot, current->class, current->location, current->rotor,
current->rate, current->fees, current->mode);
        current = current->next;
    }
}

int endsWith(const char* str, char d){
    return (str && str[strlen(str) - 1] == d);
}//compares the last character in a string with character d for
direction, and makes sure that str is not null

void copystruct(DroneNode* source, DroneNode* distenation){
    distenation->id = source->id;
    strcpy(distenation->pilot, source->pilot);
    strcpy(distenation->class, source->class);
    strcpy(distenation->location, source->location);
    strcpy(distenation->rotor, source->rotor);
    distenation->fees = source->fees;
    distenation->mode = source->mode;
    distenation->rate = source->rate;
    distenation->next = NULL;
}//copies drone information from node source to node distenation

void insert(DroneNode* newnode, DroneNode** sortedList) {

    if (*sortedList == NULL || (*sortedList)->id > newnode->id) {
        newnode->next = *sortedList;
        *sortedList = newnode;
    }
    else {
        DroneNode* current = *sortedList;

        while (current->next != NULL && current->next->id <= newnode-
>id) {
            current = current->next;
        }
        newnode->next = current->next;
        current->next = newnode;
    }
}//inserts a node into sorted list in it's appropriate place depending
on drone id

void* findDirection(char d){

    DroneNode *current = list, *newNode = NULL, *sortedList = NULL;
    while (current) {
        if(endsWith(current->location, d)){
```

```
            if((newNode = (DroneNode*)malloc(sizeof(DroneNode))) ==
NULL) {
                exit(1);
            }
            copystruct(current, newNode);
            insert(newNode, &sortedList);
        }
        current = current->next;
    }

    return sortedList;
}
```