

ASSIGNMENT 4 REPORT - MUHAMMET FATİH ALBAYIN

CODE FOR THE ASSIGNMENT



```
 1 #include <stdio.h>
 2 #include <math.h>
 3
 4
 5 void enterParameters(){
 6
 7     double velocity;           /* For taking the parameters from the user */
 8     double gravity = 9.8;      /* Initial velocity */
 9     double height;            /* Gravity parameter (default value is 9.8) */
10     double maxHeight;         /* Initial height */
11     double flightDur;         /* Maximum altitude in trajectory */
12     double a;                 /* Duration of flight */
13     int a;
14     printf("Enter initial velocity (m/s): ");
15     a = scanf("%lf", &velocity);
16     if(a == 0){               /* To check the return value of scanf */
17         printf("Please enter a valid input!\n");
18         return;
19     }
20     else if (velocity < 0){    /* Warns the user if the input is below zero */
21         printf("You cannot enter a negative value!\n");
22         return;
23     }
24     printf("Enter gravity (m/s², default 9.8): ");
25     a = scanf("%lf", &gravity);
26     if(a == 0){
27         printf("Please enter a valid input!\n");
28         return;
29     }
30     else if (gravity <= 0){   /* Warns the user if the input is not a number */
31         printf("You need to enter a positive value!\n");
32         return;
33     }
34     printf("Enter launch height (m): ");
35     a = scanf("%lf", &height);
36     if(a == 0){
37         printf("Please enter a valid input!\n");
38         return;
39     }
40     else if (height < 0){    /* Warns the user if the input is not a number */
41         printf("You cannot enter a negative value!\n");
42         return;
43     }
44
45     maxHeight = ((velocity*velocity)/(2*gravity))+height;          /* Calculates the maximum height using the formula */
46     flightDur = (velocity + sqrt(velocity*velocity + (2*gravity*height)))/gravity; /* Calculates the flight duration using the formula */
47
48     FILE *fptr;
49
50     fptr = fopen("rocket_data.txt","w");                         /* Creates the file for rocket data */
51
52     fprintf(fptr,"%lf %lf %lf %lf", velocity, gravity, height, maxHeight, flightDur); /* Enters the parameters to the file */
53
54     fclose(fptr);                                              /* Closes the file */
55
56     printf("Rocket parameters saved to rocket_data.txt!\n");
57
58 }
59
60
61
62 void simulateTrajectory(){
63
64     FILE *fptr;                                              /* For printing the trajectory to the console */
65
66     fptr = fopen("rocket_data.txt","r");                         /* Opens the rocket data file in reading mode */
67
68     if(fptr==NULL){                                           /* Warns the user if the file does not exist */
69         printf("You should firstly enter the parameters from the first option!\n");
70         return;
71     }
72
73     double velocity, gravity, height, maxHeight, flightDur;
74     int col, row;                                            /* Variables for columns and rows of the graph */
75
76     fscanf(fptr,"%lf %lf %lf %lf", &velocity, &gravity, &height, &maxHeight, &flightDur); /* Reads the parameters from the file */
77
78     printf("Reading rocket parameters from file...\n");
79     printf("Equation: h(t) = %.1lf * t² + %.0lf * t + %.0lf\n", -gravity/2, velocity, height); /* Prints the formula*/
80
81     for (row = (int)((maxHeight/10)*2+2); row >= 0; row--) { /* Starts the row value from the maximum height and decreases , division by 10 is because we represent
82         height values by the multiples of 10 */
83         if (row > 0 && row%2==1) {                                /* Prints the height value if the conditions are satisfied */
84             printf("%3d |", ((row-1)/2) * 10);
85         }
86         else {                                                 /* Prints a gap if the row is the one with the space */
87             printf("    ");
88         }
89
90         for (col = 0; col <= (int)(flightDur+1); col++) { /* Starts the column value from zero and increases until it is the flight duration + 1 */
91             if (row == 0) {                                /* Prints the x values other than 0 with one gap */
92                 if(col%2==0 && col!=0)
93                     printf("%2d|", col);
94                 else if(col == 0)
95                     printf("%4d|", col);
96                 else
97                     printf("    ");
98             }
99             /* Prints gap if the column is odd numbered */
100        }
101    }
102}
```

```

100
101     else if (row == 1){                                /* Prints the x axis */
102         if(col%2 == 0 && col != 0)
103             printf("-|");
104         else if(col == 0)
105             printf("...|");
106         else
107             printf("...|");
108     }
109     else {
110         double t = col;
111         double altitude = -(gravity / 2) * t * t + velocity * t + height;    /* Formula for calculating the altitude */
112         int scaled_altitude = (int)(altitude / 10 + 0.5);                      /* Scales the altitude to be multiples of 10 and rounds it manually
113                                         for the accuracy of the graph */
114
115         if (scaled_altitude * 2 == row - 1) {           /* Prints "#" if the x and y values match */
116             if(col == 0)
117                 printf("#");
118             else
119                 printf("#");
120         } else {
121             if(col == 0)
122                 printf("   ");
123             else
124                 printf("   ");
125         }
126     }
127     printf("\n");                                     /* Gets to the next line */
128 }
129
130 fclose(fptr);                                       /* Closes the file */
131 }
132 }
133
134 void saveTrajectory(){                               /* Saves the trajectory and some data to the file */
135
136 FILE *fptr;
137
138 fptr = fopen("rocket_data.txt","r");                /* Opens the file in readable mode */
139
140 if(fptr==NULL){                                    /* Warns the user if the file does not exist */
141     printf("You should firstly enter the parameters from the first option!\n");
142     return;
143 }
144
145 double velocity, gravity, height, maxHeight, flightDur;
146 int col, row;
147
148 fscanf(fptr,"%lf %lf %lf %lf", &velocity, &gravity, &height, &maxHeight, &flightDur); /* Reads rocket data from the file */
149
150 printf("Saving trajectory data...\n");
151
152 fclose(fptr);                                      /* Closes data file */
153
154 FILE *file;
155
156 file = fopen("trajectory.txt", "w");                /* Opens the trajectory file to print the graph */
157
158 for (row = (int)((maxHeight/10)*2+2); row >= 0; row--) { /* Does the same trajectory process on the file */
159     if (row > 0 && row%2==1) {
160         fprintf(file, "%3d |", ((row-1)/2) * 10);
161     }
162     else {
163         fprintf(file, "   ");
164     }
165
166     for (col = 0; col <= (int)(flightDur+1); col++) {
167         if (row == 0) {
168             if(col%2==0 && col!=0)
169                 fprintf(file, "%2d", col);
170             else if(col == 0)
171                 fprintf(file, "%4d", col);
172             else
173                 fprintf(file, "   ");
174         }
175         else if (row == 1){
176             if(col%2 == 0 && col != 0)
177                 fprintf(file, "-|");
178             else if(col == 0)
179                 fprintf(file, "...|");
180             else
181                 fprintf(file, "...|");
182         }
183     }
184     else {
185         double t = col;
186         double altitude = -(gravity / 2) * t * t + velocity * t + height;
187         int scaled_altitude = (int)(altitude / 10 + 0.5);
188
189         if (scaled_altitude * 2 == row - 1) {
190             if(col == 0)
191                 fprintf(file, "#");
192             else
193                 fprintf(file, "#");
194         } else {
195             if(col == 0)
196                 fprintf(file, "   ");
197             else
198                 fprintf(file, "   ");
199         }
}

```

```

200         }
201     }
202     fprintf(file, "\n");
203 }
204 printf("Maximum altitude: %.2lf\n", maxHeight);           /* Prints the values both to the screen and to trajectory.txt */
205 printf("Total flight duration: %.2lf\n", flightDur);
206 fprintf(file, "Maximum altitude: %.2lf\n", maxHeight);
207 fprintf(file , "Total flight duration: %.2lf\n", flightDur);
208
209 printf("Graph saved to trajectory.txt!\n");
210
211 fclose(file);
212
213 }
214
215 void menu(){                                         /* Menu function to navigate the user */
216
217 char cho;                                         /* Variable for the option */
218
219 printf("\nWelcome to the Rocket Launch Simulator!\n");
220 printf("-----\n");
221 printf("1. Enter launch parameters\n");
222 printf("2. Simulate rocket trajectory\n");
223 printf("3. Save trajectory data\n");
224 printf("4. Exit\n");
225 printf("Choice: ");
226 scanf(" %c", &cho);
227
228 switch(cho){                                     /* Navigates the user to the required function based on the input */
229 case '1':
230     enterParameters();
231     break;
232 case '2':
233     simulateTrajectory();
234     break;
235 case '3':
236     saveTrajectory();
237     break;
238 case '4':
239     printf("Terminating the simulator...\n");
240     return;
241     break;
242 default:
243     printf("Please enter a valid value!\n");        /* Warns the user if the input is not valid */
244 }
245 }
246
247
248
249
250 int main(){                                         /* Starts the process by calling the menu function */
251
252 menu();
253
254 }
```

THE GENERATED OUTPUT

FIRST RUN

```

albay@albay-VirtualBox:~/Desktop$ gcc -ansi MuhammetFatih_Albayin.c -o m -lm
albay@albay-VirtualBox:~/Desktop$ ./m

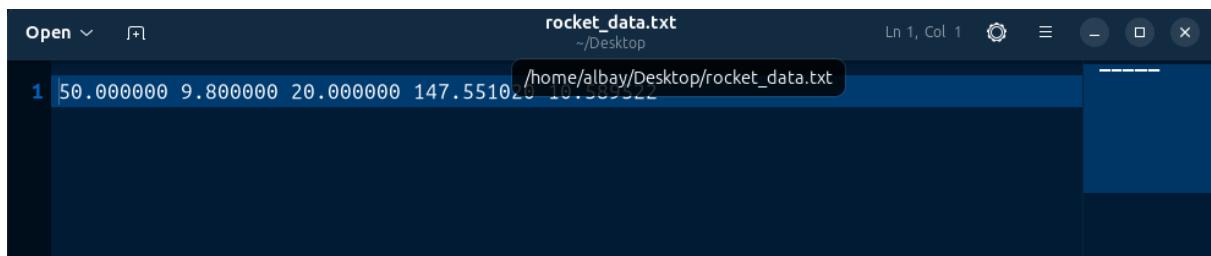
Welcome to the Rocket Launch Simulator!
-----
1. Enter launch parameters
2. Simulate rocket trajectory
3. Save trajectory data
4. Exit
Choice: 1
Enter initial velocity (m/s): 50
Enter gravity (m/s2, default 9.8): 9.8
Enter launch height (m): 20
Rocket parameters saved to rocket_data.txt!
```

SECOND RUN

THIRD RUN

```
albay@albay-VirtualBox:~/Desktop$ ./m  
  
Welcome to the Rocket Launch Simulator!  
-----  
1. Enter launch parameters  
2. Simulate rocket trajectory  
3. Save trajectory data  
4. Exit  
Choice: 3  
Saving trajectory data...  
Maximum altitude: 147.55  
Total flight duration: 10.59  
Graph saved to trajectory.txt!  
albay@albay-VirtualBox:~/Desktop$
```

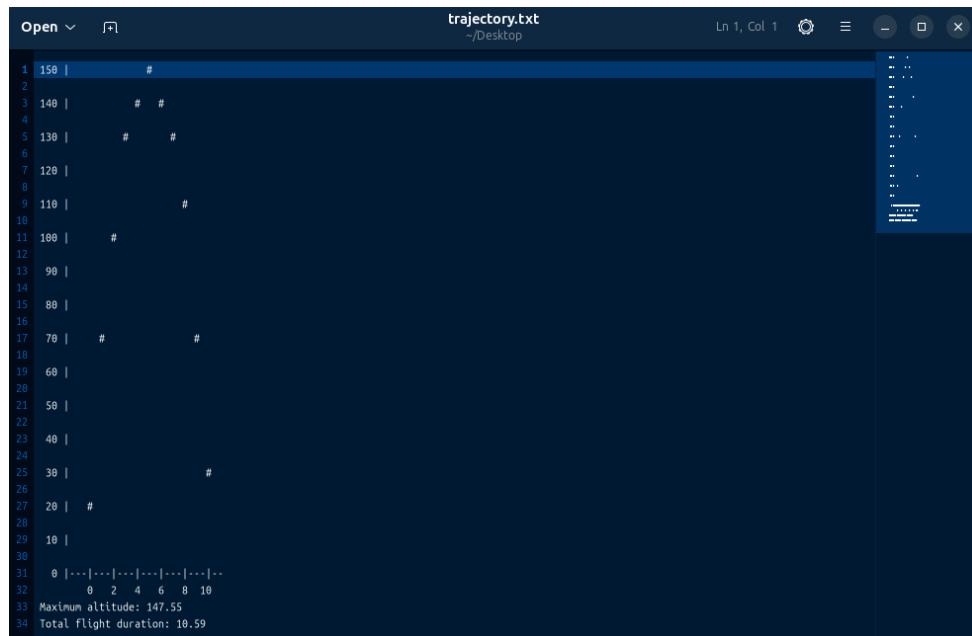
ROCKET DATA FILE



The screenshot shows a terminal window with the title "rocket_data.txt" and the path "/home/albay/Desktop". The window displays the following text:

```
1 50.000000 9.800000 20.000000 147.551020 10.589322
```

TRAJECTORY FILE



The screenshot shows a terminal window with the title "trajectory.txt" and the path "/home/albay/Desktop". The window displays the following text, which includes a vertical column of numbers and a summary at the bottom:

```
1 150 |      #
2
3 140 |      #  #
4
5 130 |      #  #
6
7 120 |
8
9 110 |          #
10
11 100 |      #
12
13 90 |
14
15 80 |
16
17 70 |      #          #
18
19 60 |
20
21 50 |
22
23 40 |
24
25 30 |          #
26
27 20 |      #
28
29 10 |
30
31 0 |....|....|....|....|....|...
32      0 2 4 6 8 10
33 Maximum altitude: 147.55
34 Total flight duration: 10.59
```