# ENSF 614 – Fall 2021

Lab 1 – Tuesday, September 14

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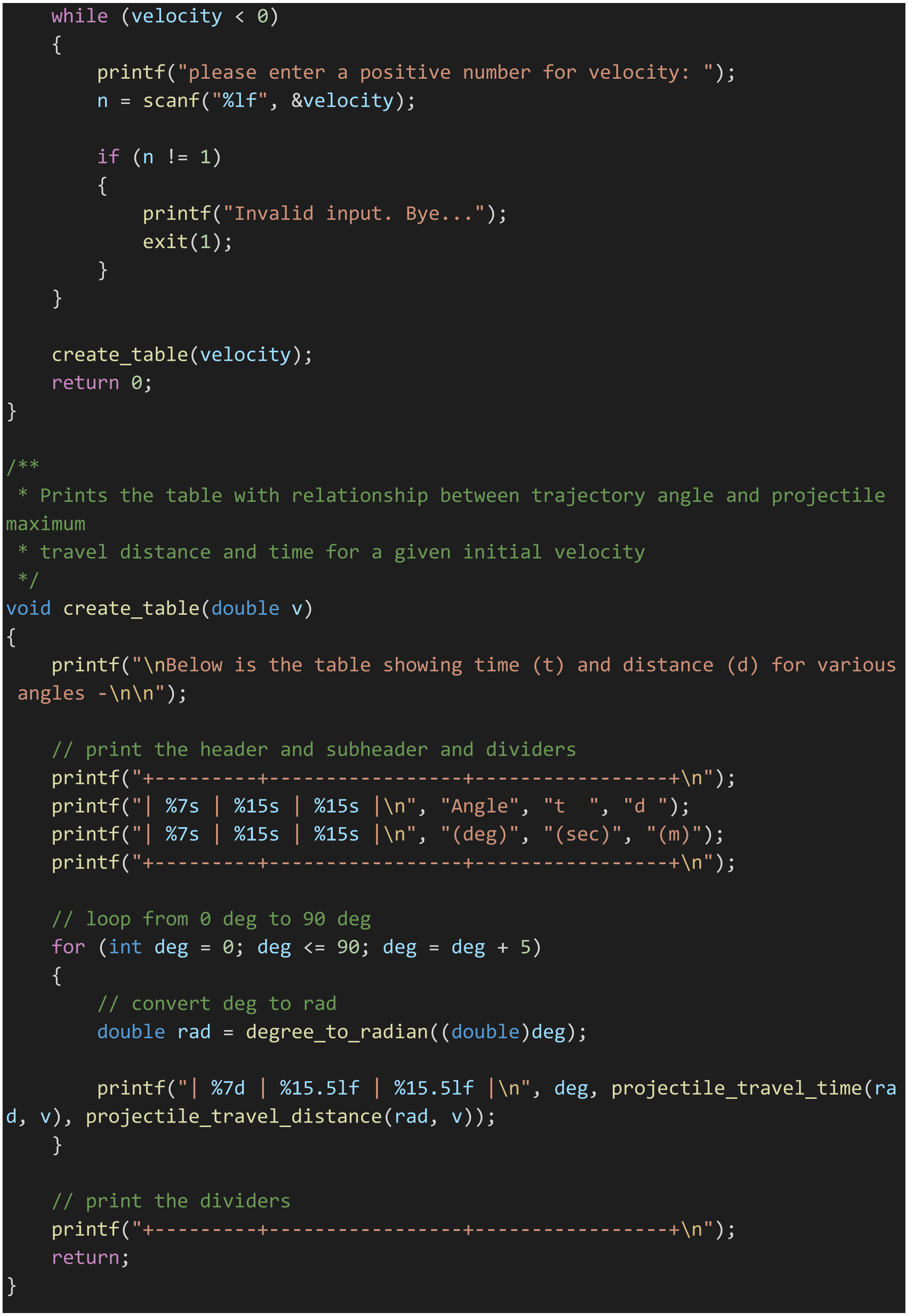
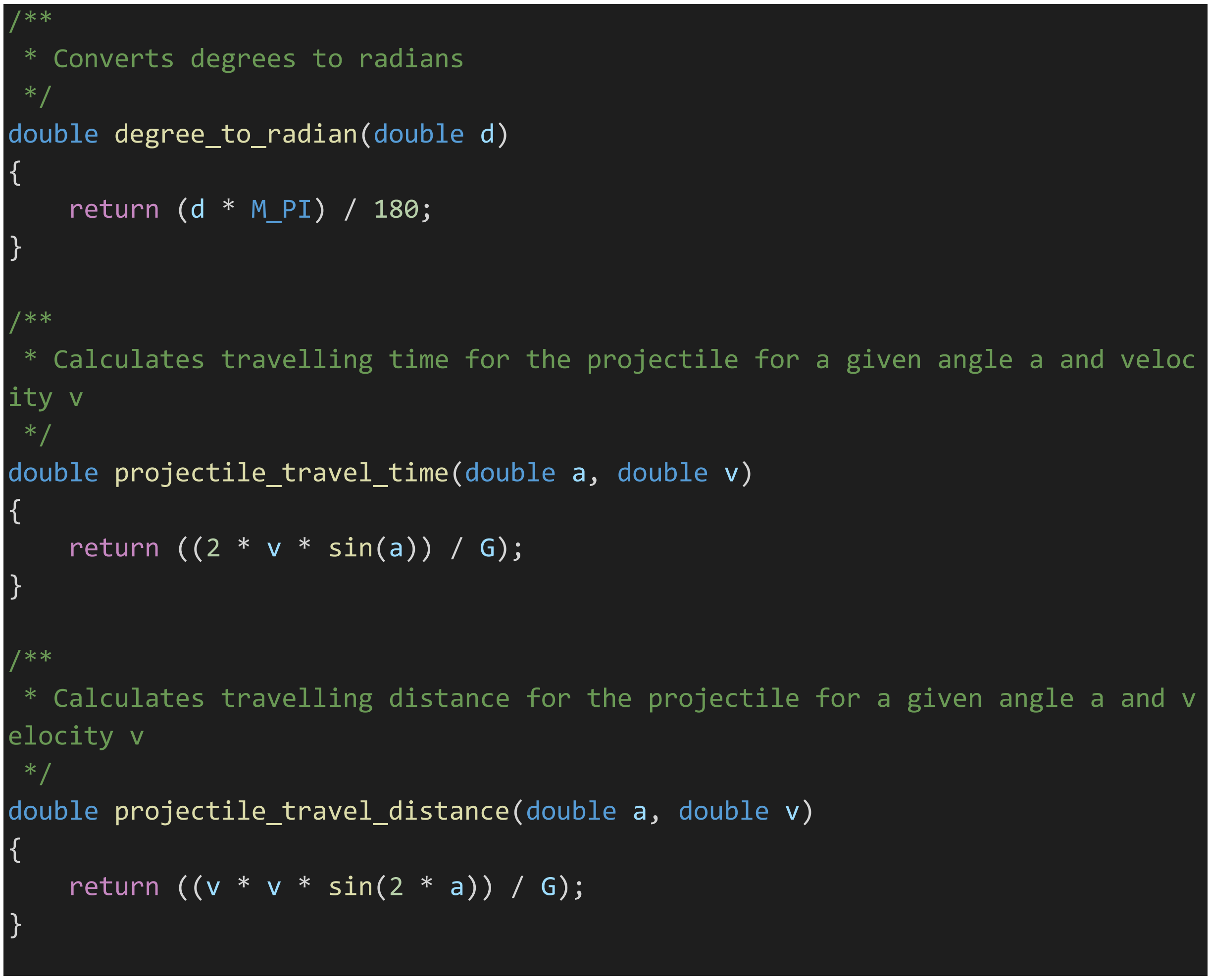
Submission date: September 14, 2021

## Exercise B – Source Code

```
/*
 * File Name:                lab1exe_B.c
 * Course:                   ENSF 614 - Fall 2021
 * Lab # and Assignment #:   Lab 1 Exercise B
 * Lab section:              B01
 * Completed by:             Bhavyai Gupta
 * Submission Date:          September 14, 2021
 */

#include <stdio.h>
#include <stdlib.h>
#include <math.h>

const double G = 9.8; /* gravitation acceleration 9.8 m/s^2 */
const double PI = 3.141592654;

void create_table(double v);
double projectile_travel_time(double a, double v);
double projectile_travel_distance(double a, double v);
double degree_to_radian(double d);

int main(void)
{
    int n;
    double velocity;

    printf("Please enter the velocity at which the projectile is launched (m/sec):
 ");
    n = scanf("%lf", &velocity);

    if (n != 1)
    {
        printf("Invalid input. Bye...");
        exit(1);
    }
```

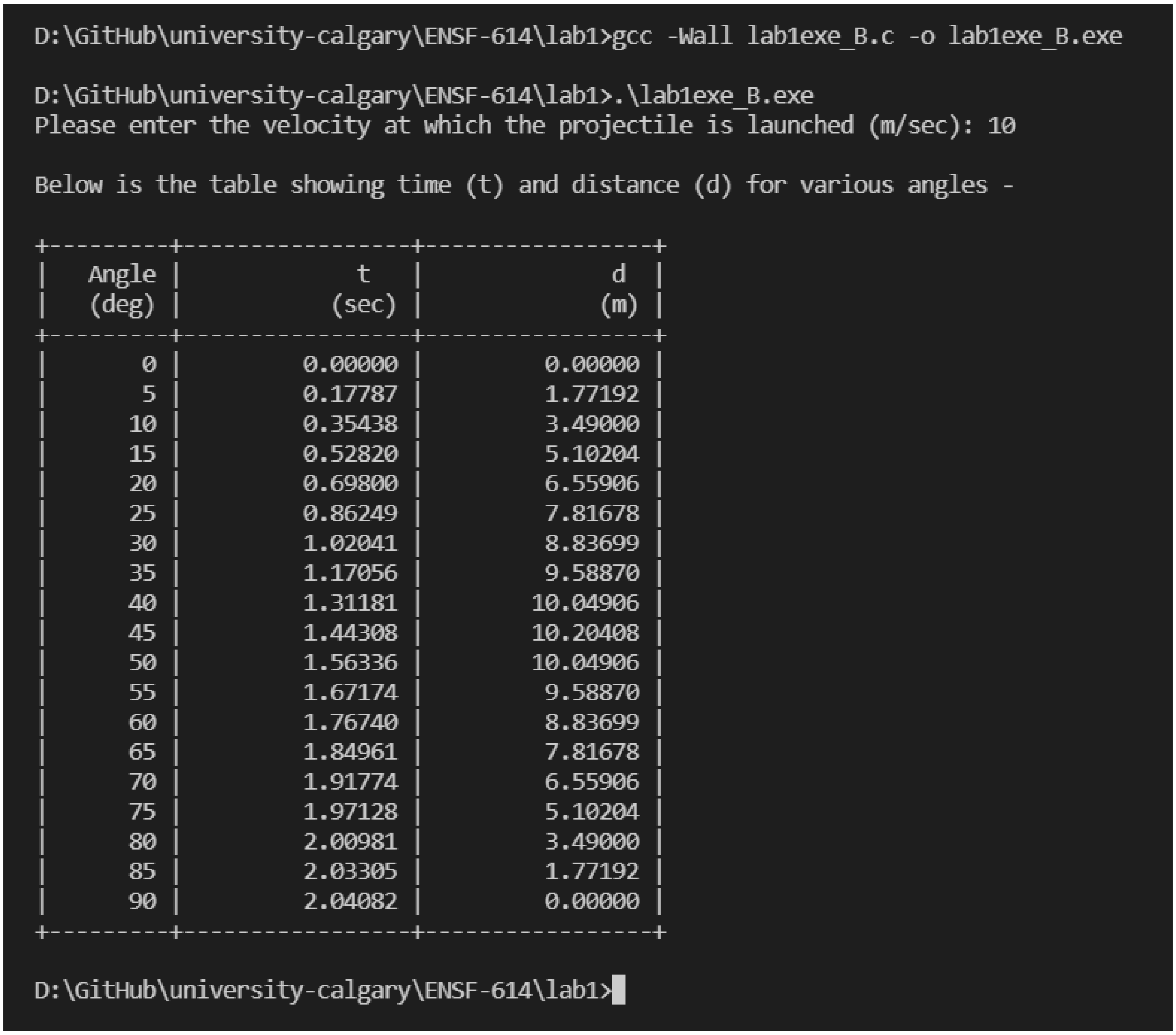


```
    while (velocity < 0)
    {
        printf("please enter a positive number for velocity: ");
        n = scanf("%lf", &velocity);

        if (n != 1)
        {
            printf("Invalid input. Bye...");
            exit(1);
        }
    }

    create_table(velocity);
    return 0;
}

/**
 * Prints the table with relationship between trajectory angle and projectile
maximum
 * travel distance and time for a given initial velocity
 */
void create_table(double v)
{
    printf("\nBelow is the table showing time (t) and distance (d) for various
 angles -\n\n");

    // print the header and subheader and dividers
    printf("+---------+-----------------+-----------------+\n");
    printf("| %7s | %15s | %15s |\n", "Angle", "t  ", "d ");
    printf("| %7s | %15s | %15s |\n", "(deg)", "(sec)", "(m)");
    printf("+---------+-----------------+-----------------+\n");

    // loop from 0 deg to 90 deg
    for (int deg = 0; deg <= 90; deg = deg + 5)
    {
        // convert deg to rad
        double rad = degree_to_radian((double)deg);

        printf("| %7d | %15.5lf | %15.5lf |\n", deg, projectile_travel_time(ra
d, v), projectile_travel_distance(rad, v));
    }

    // print the dividers
    printf("+---------+-----------------+-----------------+\n");
    return;
}
```



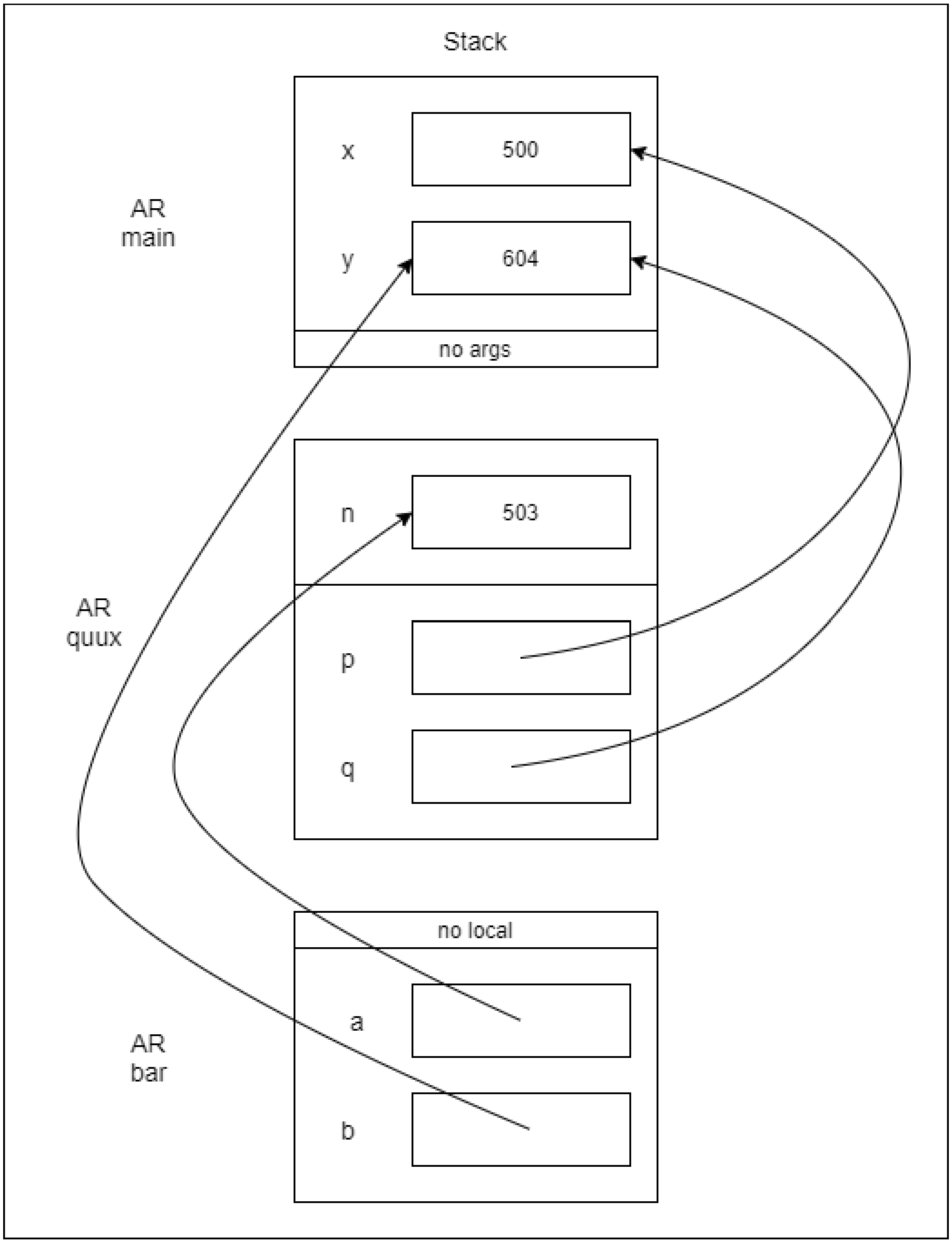
```
/**
 * Converts degrees to radians
 */
double degree_to_radian(double d)
{
    return (d * M_PI) / 180;
}

/**
 * Calculates travelling time for the projectile for a given angle a and veloc
ity v
 */
double projectile_travel_time(double a, double v)
{
    return ((2 * v * sin(a)) / G);
}

/**
 * Calculates travelling distance for the projectile for a given angle a and v
elocity v
 */
double projectile_travel_distance(double a, double v)
{
    return ((v * v * sin(2 * a)) / G);
}
```

## Exercise B – Program Output

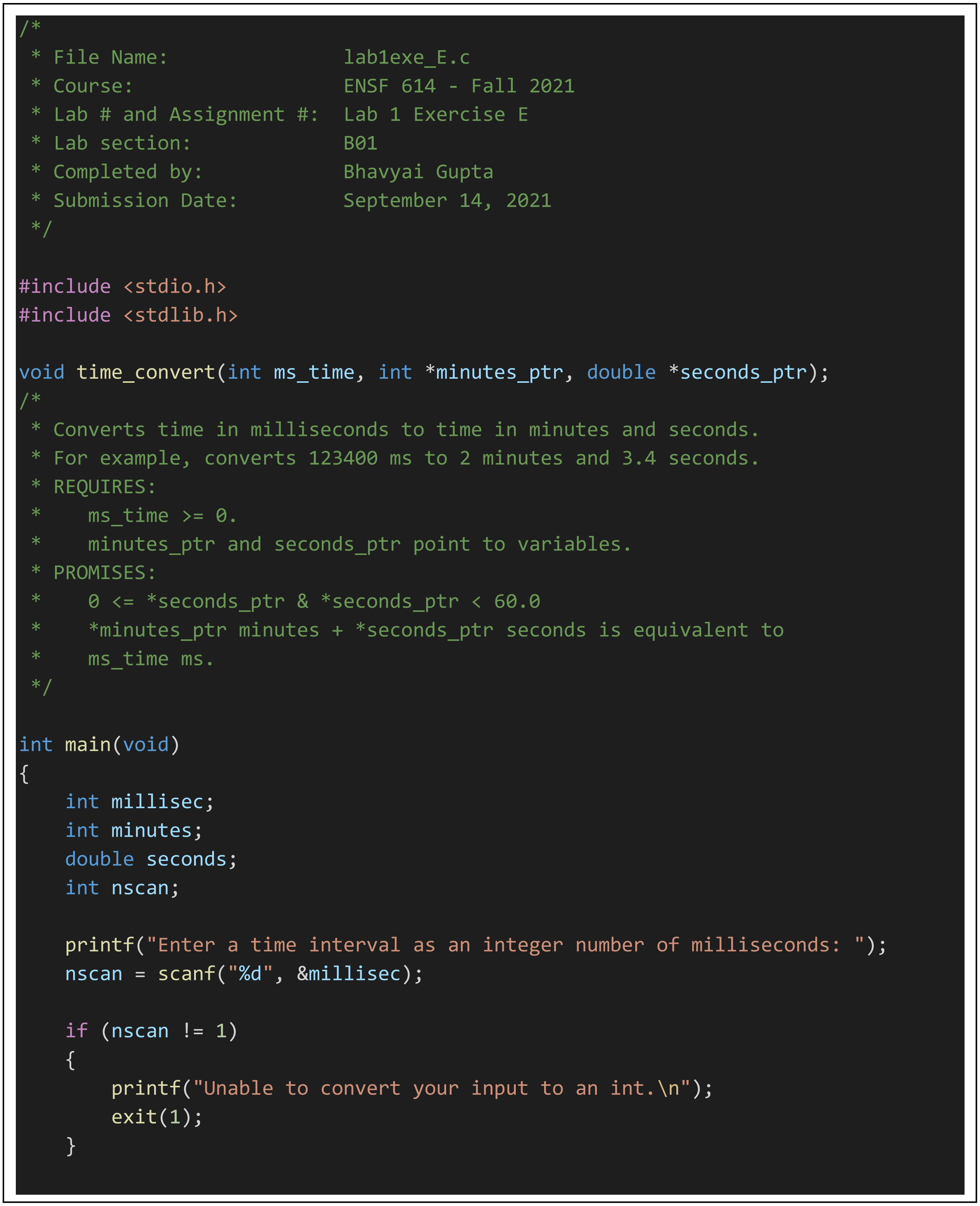


```
D:\GitHub\university-calgary\ENSF-614\lab1>gcc -Wall lab1exe_B.c -o lab1exe_B.exe

D:\GitHub\university-calgary\ENSF-614\lab1>.\lab1exe_B.exe
Please enter the velocity at which the projectile is launched (m/sec): 10

Below is the table showing time (t) and distance (d) for various angles -

+---------+-----------------+-----------------+
|   Angle |             t   |              d  |
|   (deg) |           (sec) |             (m) |
+---------+-----------------+-----------------+
|       0 |         0.00000 |         0.00000 |
|       5 |         0.17787 |         1.77192 |
|      10 |         0.35438 |         3.49000 |
|      15 |         0.52820 |         5.10204 |
|      20 |         0.69800 |         6.55906 |
|      25 |         0.86249 |         7.81678 |
|      30 |         1.02041 |         8.83699 |
|      35 |         1.17056 |         9.58870 |
|      40 |         1.31181 |        10.04906 |
|      45 |         1.44308 |        10.20408 |
|      50 |         1.56336 |        10.04906 |
|      55 |         1.67174 |         9.58870 |
|      60 |         1.76740 |         8.83699 |
|      65 |         1.84961 |         7.81678 |
|      70 |         1.91774 |         6.55906 |
|      75 |         1.97128 |         5.10204 |
|      80 |         2.00981 |         3.49000 |
|      85 |         2.03305 |         1.77192 |
|      90 |         2.04082 |         0.00000 |
+---------+-----------------+-----------------+

D:\GitHub\university-calgary\ENSF-614\lab1>
```

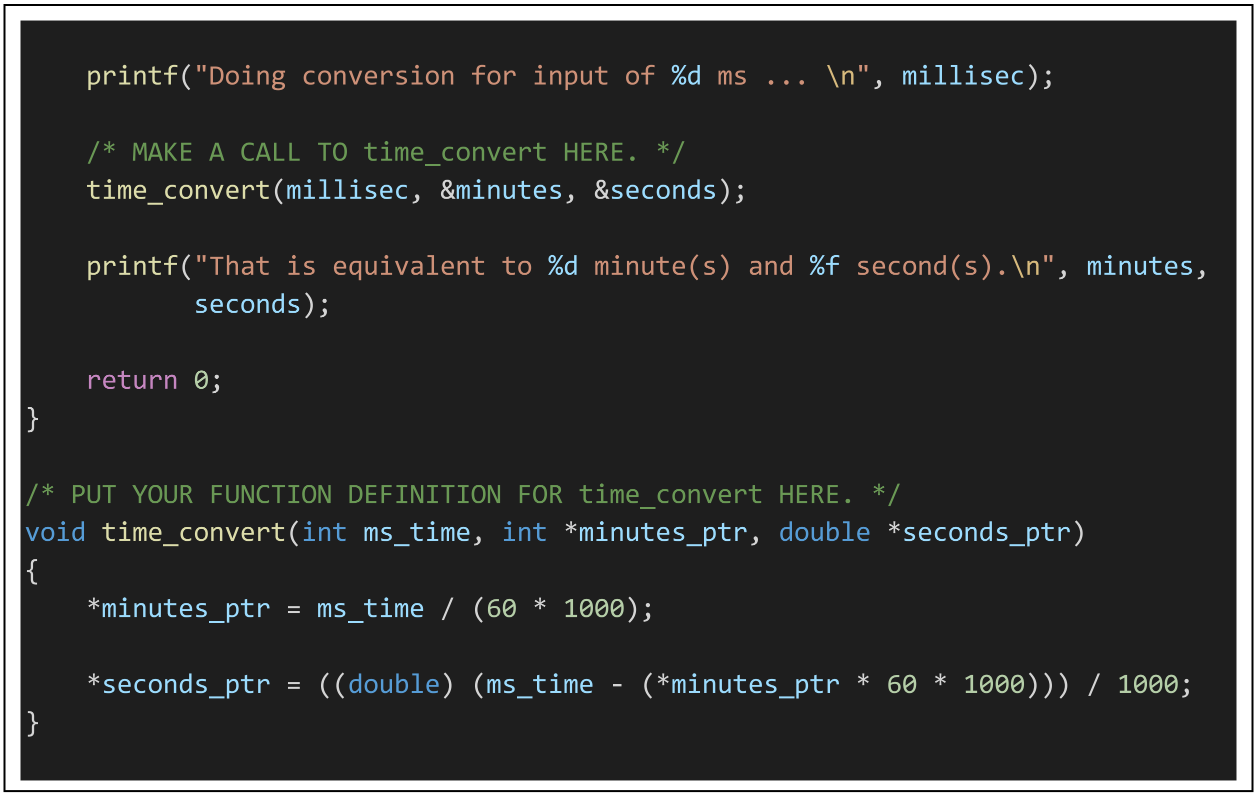
## Exercise D Part Two – AR Diagram



## Exercise E – Source Code

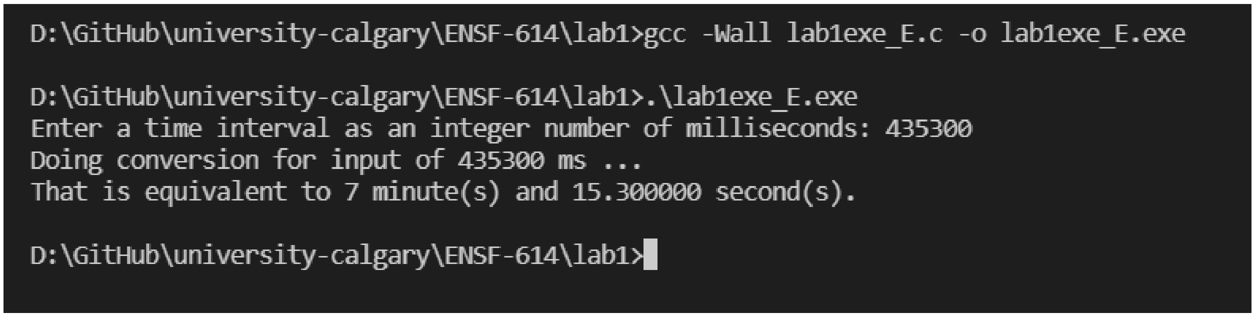


```c
/*
 * File Name:               lab1exe_E.c
 * Course:                  ENSF 614 - Fall 2021
 * Lab # and Assignment #:  Lab 1 Exercise E
 * Lab section:             B01
 * Completed by:            Bhavyai Gupta
 * Submission Date:         September 14, 2021
 */

#include <stdio.h>
#include <stdlib.h>

void time_convert(int ms_time, int *minutes_ptr, double *seconds_ptr);
/*
 * Converts time in milliseconds to time in minutes and seconds.
 * For example, converts 123400 ms to 2 minutes and 3.4 seconds.
 * REQUIRES:
 *    ms_time >= 0.
 *    minutes_ptr and seconds_ptr point to variables.
 * PROMISES:
 *    0 <= *seconds_ptr & *seconds_ptr < 60.0
 *    *minutes_ptr minutes + *seconds_ptr seconds is equivalent to
 *    ms_time ms.
 */

int main(void)
{
    int millisec;
    int minutes;
    double seconds;
    int nscan;

    printf("Enter a time interval as an integer number of milliseconds: ");
    nscan = scanf("%d", &millisec);

    if (nscan != 1)
    {
        printf("Unable to convert your input to an int.\n");
        exit(1);
    }
```



```c
    printf("Doing conversion for input of %d ms ... \n", millisec);

    /* MAKE A CALL TO time_convert HERE. */
    time_convert(millisec, &minutes, &seconds);

    printf("That is equivalent to %d minute(s) and %f second(s).\n", minutes,
           seconds);

    return 0;
}

/* PUT YOUR FUNCTION DEFINITION FOR time_convert HERE. */
void time_convert(int ms_time, int *minutes_ptr, double *seconds_ptr)
{
    *minutes_ptr = ms_time / (60 * 1000);

    *seconds_ptr = ((double) (ms_time - (*minutes_ptr * 60 * 1000))) / 1000;
}
```

## Exercise E – Program Output



```
D:\GitHub\university-calgary\ENSF-614\lab1>gcc -Wall lab1exe_E.c -o lab1exe_E.exe

D:\GitHub\university-calgary\ENSF-614\lab1>.\lab1exe_E.exe
Enter a time interval as an integer number of milliseconds: 435300
Doing conversion for input of 435300 ms ...
That is equivalent to 7 minute(s) and 15.300000 second(s).

D:\GitHub\university-calgary\ENSF-614\lab1>
```