

[HW 6-1]

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

//HW6-1

int main() {
    FILE *fileout;
    double N, point, Rx, Ry;

    fileout = fopen( filename: "/Users/Austin/Desktop/PHY 48/Homework/6/HW6_1.txt", mode: "w" );

    N = 10000;
    //generates 1000 random numbers
    for (point = 0; point < N; point = point + 1) {
        Rx = (double)rand() / RAND_MAX;
        Ry = (double)rand() / RAND_MAX;
        fprintf(fileout, "\n%.4f %.4f", Rx, Ry);
    }
    fclose(fileout);
    return 0;
}

//HW6-2
//int main() {
//FILE *fileout;
```

[HW 6-2]

i. 100

```
//HW6-2

int main() {
    FILE *fileout;
    double N, point, M, Rx, Ry;

    fileout = fopen( filename: "/Users/Austin/Desktop/PHY 48/Homework/6/HW6_1.txt", mode: "w" );

    N = 1000;
    M = 0;
    //generates 1000 random numbers
    for (point = 0; point < N; point = point + 1) {
        Rx = (double)rand() / RAND_MAX;
        Ry = (double)rand() / RAND_MAX;
        if (pow(Rx,2) + pow(Ry,2) < 1) // if sum of each square < 1 M = M + 1
            M = M + 1;
        fprintf(fileout, "\n%.4f %.4f", Rx, Ry);
    }
    printf("\nM = %.4f", M);
    printf("\nN is %.4f", N/M);
    fclose(fileout);
    return 0;
}
```

ii. 10000

The screenshot shows a C IDE interface with the following details:

- Project:** HW6.c
- File:** HW6.c
- Code:** A C program that generates 1000 random points (Rx, Ry) between 0 and 1. It counts the points where $Rx^2 + Ry^2 \leq 1$. The ratio M/N is calculated and printed as approximately 3.14159.

```
HW6.c
6 HW6.c
CMakeLists.txt HW6.c
24
25
26 //HW6-2]
27
28 int main() {
29     FILE *fileout;
30     double N, point, M, Rx, Ry;
31
32     fileout = fopen( filename: "/Users/Austin/Desktop/PHY 48/Homework/6/HW6_1.txt", mode: "w");
33
34     N = 10000;
35     M = 0;
36     //generates 1000 random numbers
37     for (point = 1; point < N; point = point + 1) {
38         Rx = (double)rand() / RAND_MAX;
39         Ry = (double)rand() / RAND_MAX;
40         if (pow(Rx, 2) + pow(Ry, 2) < 1) // if sum of each square < 1 M = M + 1
41             M = M + 1;
42         fprintf(fileout, "%d,%lf,%lf", Rx, Ry);
43     }
44     printf("\nN = %d", M);
45     printf("\nN/N is %f", M/N);
46     fclose(fileout);
47     return 0;
48 }
49
50 main
```

- Run:** Shows the output window with the following text:

```
M = 7874.0000
M/N is 0.7874
Process finished with exit code 0
```
- Bottom Bar:** Includes icons for Run, CMake, Terminal, Messages, TODO, and Event Log.

iii. 1000000

The screenshot shows a C IDE interface with the following details:

- Project Explorer:** Shows files CMakelists.txt and HW6.c.
- Code Editor:** HW6.c file open, containing a program to generate random numbers and calculate the ratio M/N. The code includes comments explaining the logic of summing values less than 1 and incrementing M.
- Terminal:** Shows the output of the run command, displaying the calculated value of M (785524.0000) and the ratio M/N (0.7855).
- Status Bar:** Shows the current build configuration as "6 | Debug".

iv. 100000000

The screenshot shows a C IDE interface with the following details:

- Project:** HW6.c
- Code Editor:** The file `HW6.c` is open, containing the following code:

```
24 //HW6-2]
25
26 int main() {
27     FILE *fileout;
28     double N, point, M, Rx, Ry;
29
30     fileout = fopen( filename: "/Users/Austin/Desktop/PHY 48/Homework/s/HW6_1.txt", mode: "w" );
31
32     N = 1000000000;
33     M = 0;
34
35     //generates 1000 random numbers
36     for (point = 0; point < N; point = point + 1) {
37         Rx = (double)rand() / RAND_MAX;
38         Ry = (double)rand() / RAND_MAX;
39
40         if (pow(Rx, 2) + pow(Ry, 2) < 1) // if sum of each square < 1 M = M + 1
41             M = M + 1;
42
43         fprintf(fileout, "\n%.4lf %.4lf", Rx, Ry);
44
45     }
46     printf("\nM = %.4lf", M);
47     printf("\nN is %.4lf", N/M);
48     fclose(fileout);
49
50     return 0;
51 }
```
- Run Tab:** Shows the process has completed successfully with exit code 0.
- Output:** The terminal window displays the following output:

```
M = 78535956.8888
M/N is 0.7854
Process finished with exit code 0
```

[HW6-4]

i. 10 iterations

The screenshot shows a C IDE interface with the following details:

- Project:** HW6.c
- File:** HWB.c
- Code:** The code is a C program that reads a matrix from a file and performs a specific operation. It includes a loop to read iterations and nested loops to process the matrix elements.

```
6 HW6.c
6 | Project CMakeLists.txt HWB.c
50
51 //HW6-4
52
53 int main(void)
54 {
55     FILE *fileout;
56     int ix,iy,it,Nt;
57     double new[31][21],V[31][21],x,dx,y,dy; //nxm matrix
58     fileout=fopen( &filename: "/Users/Austin/Desktop/PHY 40/Homework/6/HW6_3.dat", mode: "w");
59     printf("Enter number of iterations ");
60     scanf("%d",&Nt); dx=0.10;dy=0.10;
61     for (iy=0; iy<21; iy=iy+1)
62     {
63         for (ix=0; ix<31; ix=ix+1)
64         {
65             V[ix][iy]=0.0;
66         }
67     }
68     iy=20;
69     for (ix=0; ix<31; ix=ix+1)
70     {
71         V[ix][iy]=0.0;
72     }
73     for (it=0; it<Nt; it=it+1)
74     {
75         for (iy=1; iy<20; iy=iy+1)
76         {
77             for (ix=1; ix<30; ix=ix+1)
78             {
79                 if (V[iy][ix]<=0.8)
80                     V[iy][ix]=0.0;
81             }
82         }
83     }
84 }
```

- Run:** The terminal window shows the output of the program. It asks for the number of iterations (10), then displays the value at the box center (0.000000), and finally indicates the process finished with exit code 0.

```
6 x
"/Users/Austin/Desktop/PHY 40/Homework/6/cmake-build-debug/6"
Enter number of iterations 10
V at box center 0.000000
Process finished with exit code 0
```

ii. 20 iterations

The screenshot shows a C IDE interface with the following details:

- Project:** HW6.c
- File Structure:** HW6.c
- Code Editor:** HW6.c (Line 58 to 78) contains a C program for a matrix operation. It includes a loop to read a matrix from a file, a nested loop to calculate a value at the center of a box, and another nested loop to update matrix elements.
- Run Tab:** Shows the command run: "/Users/Austin/Desktop/PHY 40/Homework/6/cmake-build-debug/6". The terminal output shows the user entering "Enter number of iterations: 20", the calculated value "V at box center 0.011604", and the message "Process finished with exit code 0".
- Bottom Status Bar:** Displays "4: Run" and "Process finished with exit code 0".

iii. 50 iterations

The screenshot shows a C IDE interface with the following details:

- Project:** HW6.c
- Code Editor:** The main window displays the source code for `HW6.c`. The code includes a header guard, a main function that reads a matrix from a file, initializes it with zeros, and performs iterative calculations. It uses nested loops for matrix multiplication and updates the matrix `V`.
- Run Tab:** The "Run" tab shows the command run: `"/Users/Austin/Desktop/PHY 40/Homework/6/cmake-build-debug/6"`. The output window shows the user entering the number of iterations (20) and the resulting value at the box center (0.367847).
- Status Bar:** The status bar at the bottom indicates the process finished with exit code 0.

iv. 100 iterations

The screenshot shows a C IDE interface with the following details:

- Project:** HW6.c
- Code Editor:** The file HW6.c contains C code for a matrix operation. The code includes a main function that reads iteration counts from the user, initializes a matrix V with zeros, and performs a nested loop operation. The nested loops iterate over indices ix, iy, and it.
- Terminal:** The terminal window shows the execution of the program. It prompts for the number of iterations (100), displays the value at the box center (1.237277), and concludes with "Process finished with exit code 0".
- Status Bar:** The status bar at the bottom indicates the run configuration (4: Run), build status (CMake), terminal status (Terminal), message count (0: Messages), and the current file (HW6.c). It also shows the file size (8:1), encoding (LF), character count (UTF-8), word count (4 spaces), and line count (C: 6).

v. 200 iterations

The screenshot shows a C IDE interface with the following details:

- Project:** HW6.c
- Code Editor:** The main window displays the source code `HW6.c`. The code initializes a matrix `V` with zeros, reads the number of iterations from the user, and then performs a nested loop operation on the matrix. The code uses `FILE` pointers and `double` precision for matrix elements.
- Terminal:** The bottom panel shows the terminal output. It prompts for the number of iterations (200), displays the value at the center of the matrix (2.295335), and concludes with "Process finished with exit code 0".
- Status Bar:** The status bar at the bottom indicates the file is saved (green icon), the build configuration is "Debug" (blue icon), and the terminal tab is active.

vi. 500 iterations

The screenshot shows a code editor window with the file `HW6.c` open. The code implements a matrix-vector multiplication algorithm. It reads input parameters from a file `HW6_3.dat`, initializes a matrix `V` with zeros, and performs nested loops to calculate the result. The output window shows the iteration count and the value at the center of the matrix.

```
FILE *fileout;
int ix,iy,it,Nt;
double newV[31][21],V[31][21],x,dx,y,dy; //nxm matrix
fileout=fopen( filename: "/Users/Austin/Desktop/PHY 40/Homework/6/HW6_3.dat", mode: "w");
printf("\nEnter number of iterations ");
scanf("%d",&Nt);dx=0.10;dy=0.10;
for (iy=0; iy<21; iy=iy+1)
{
    for (ix=0; ix<31; ix=ix+1)
    {
        V[ix][iy]=0.0;
    }
}
iy=20;
for (ix=0; ix<31; ix=ix+1)
{
    V[ix][iy]=0.0;
}
for (it=0; it<Nt; it=it+1)
{
    for (iy=1; iy<20; iy=iy+1)
    {
        for (ix=1; ix<30; ix=ix+1)
        {
            for (ix=1; ix<31; ix=ix+1)
```

Run: 6
"/Users/Austin/Desktop/PHY 40/Homework/6/cmake-build-debug/6"
Enter number of iterations 500
V at box center 2.992441
Process finished with exit code 0

vii. 1000

The screenshot shows a code editor window with the file `HW6.c` open. The code is identical to the previous version but with a higher iteration count of 1000. The output window shows the iteration count and the value at the center of the matrix.

```
FILE *fileout;
int ix,iy,it,Nt;
double newV[31][21],V[31][21],x,dx,y,dy; //nxm matrix
fileout=fopen( filename: "/Users/Austin/Desktop/PHY 40/Homework/6/HW6_3.dat", mode: "w");
printf("\nEnter number of iterations ");
scanf("%d",&Nt);dx=0.10;dy=0.10;
for (iy=0; iy<21; iy=iy+1)
{
    for (ix=0; ix<31; ix=ix+1)
    {
        V[ix][iy]=0.0;
    }
}
iy=20;
for (ix=0; ix<31; ix=ix+1)
{
    V[ix][iy]=0.0;
}
for (it=0; it<Nt; it=it+1)
{
    for (iy=1; iy<20; iy=iy+1)
    {
        for (ix=1; ix<30; ix=ix+1)
        {
            for (ix=1; ix<31; ix=ix+1)
```

Run: 6
"/Users/Austin/Desktop/PHY 40/Homework/6/cmake-build-debug/6"
Enter number of iterations 1000
V at box center 3.043288
Process finished with exit code 0

viii. 5000 iterations

The screenshot shows a code editor interface with two tabs open: `CMakeLists.txt` and `HW6.c`. The `HW6.c` tab contains the following C code:

```
6 HW6.c
58
59 //HW6-4
60
61 int main(void)
62 {
63     FILE *fileout;
64     int ix,iy,it,Nt;
65     double newV[31][21],V[31][21],x,dx,y,dy; //nxm matrix
66     fileout=fopen( filename: "/Users/Austin/Desktop/PHY 40/Homework/6/HW6_3.dat", mode: "w");
67     printf("Enter number of iterations ");
68     scanf("%d",&Nt);dx=0.10;dy=0.10;
69     for (iy=0; iy<21; iy=iy+1)
70     {
71         for (ix=0; ix<31; ix=ix+1)
72         {
73             V[ix][iy]=0.0;
74         }
75     }
76     iy=20;
77     for (ix=0; ix<31; ix=ix+1)
78     {
79         V[ix][iy]=8.0;
80     }
81     for (it=0; it<Nt; it=it+1)
82     {
83         for (iy=0; iy<20; iy=iy+1)
84         {
85             for (ix=1; ix<30; ix=ix+1)
86             {
87             }
88         }
89     }
90 }
```

The terminal window below shows the output of running the program with 5000 iterations:

```
Run: 6
"/Users/Austin/Desktop/PHY 40/Homework/6/cmake-build-debug/6"

Enter number of iterations 5000
V at box center 3.043797
Process finished with exit code 0
```

The status bar at the bottom indicates the file is saved (S1), uses LF line endings (LF), is in UTF-8 encoding (UTF-8), has 4 spaces (4 spaces), and is in Debug mode (Debug).

[HW6-5/6]