CSE521 Assignment 1 : Fourier-Motzkin Elimination

Implemented Fourier Motzkin Elimination (FME) in three steps, as follows: ## (a) Implemented in BaselineFME.cpp. Takes as input a system of inequalities, Ax ≤ b, where A is a constant matrix of mxn (m: number of inequalities and n: number of unknowns), b is an m-entry constant vector and x is an n-entry vector of unknowns. Implementation will output whether the system of inequalities have any solution or not.
Input File format

```
m n
a11 a12 a13 .. a1n
a21 a22 a23 .. a2n
..
..
am1 am2 am3 .. amn
b1
b2
..
bm
```

where m is number of rows and n is number of unknowns

Sample

For Inequations such as this

```
x1 - 4x2 <=2
x1 + 5x2 <=7
-x1 <= -3
```

Input file should be

```
3 2
1 -4
1 5
-1 0
2
7
-3
```

To run

```
$ g++ BaselineFME.cpp
$ ./a.out input.txt
```

Sample Output for (1)

```
swapnika@swapnika-VirtualBox:~/Desktop/CC/FME$ ./a.out input1.txt
.....................................................
Print Matrix
1 -4
1 5
-1 0
Print Matrix end
.....................................................
.....................................................
Print list
2 7 -3
Print list end
.....................................................
Has solution
```

image

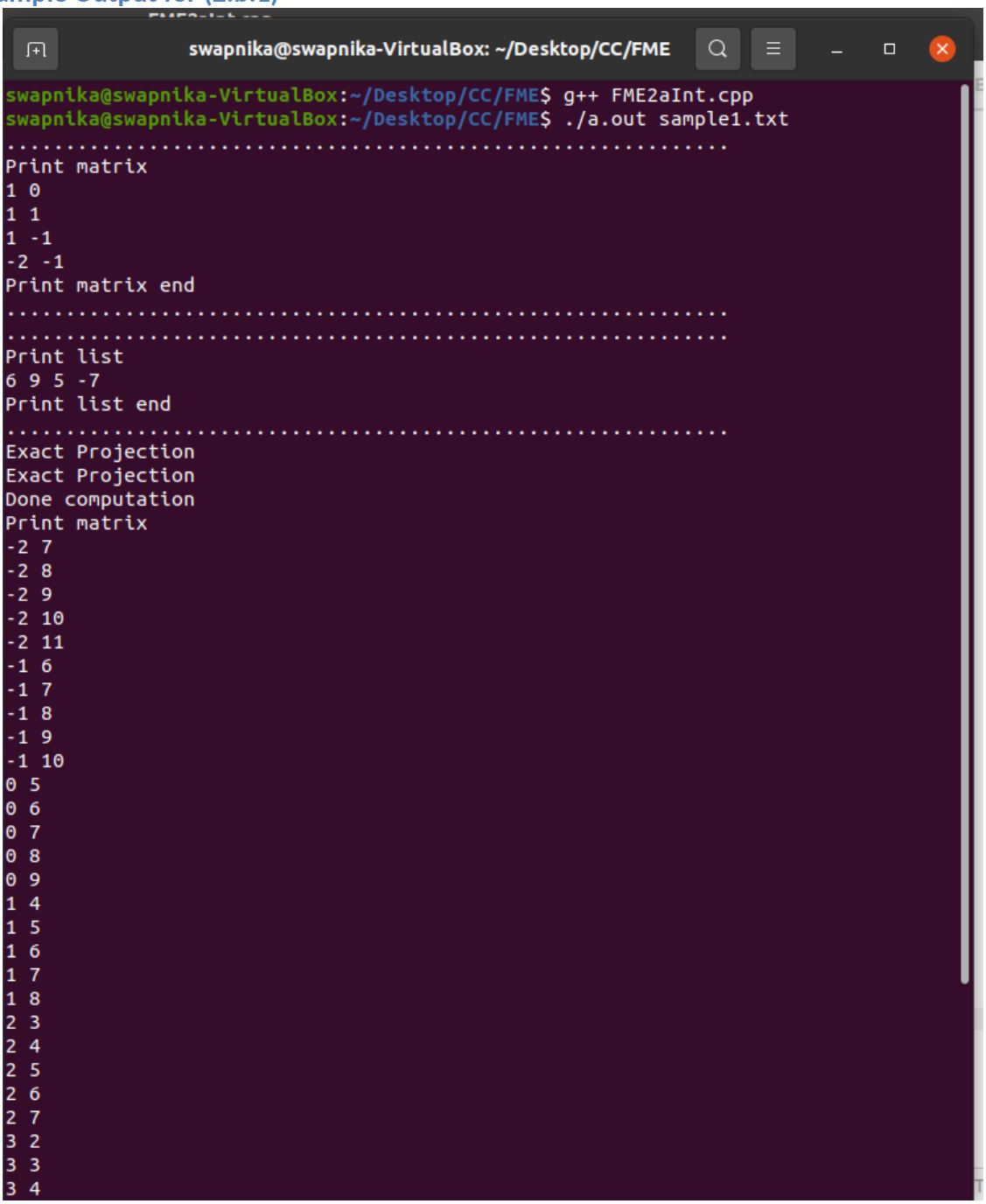
(b) This is an integer version of FME.

(b.1) In the first version, your program will declare that there is an integer solution if and only if all projections (reductions) are exact. In addition, your code should indicate whether the projection you employed at each step of the solution process was exact or inexact.

To run

```
$ g++ FME2aInt.cpp
$ ./a.out input.txt
```

Sample Output for (2.b.1)



image

(b.2) In the second version, your program is going to form “dark shadow” equations. In both the integer versions, your implementation will print out a loop nest which, when executed, prints all the integer points in the solution space.

To run

```
$ g++ FME2bDark_shadows.cpp
$ ./a.out input.txt
```

Sample Output for (2.b.2)

```
swapnika@swapnika-VirtualBox:~/Desktop/CC/FME$ g++ FME2bDark_shadows.cpp
swapnika@swapnika-VirtualBox:~/Desktop/CC/FME$ ./a.out sample1.txt
.....................................................
Print
1 0
1 1
1 -1
-2 -1
Print end
.....................................................
.....................................................
Print list
6 9 5 -7
Print list end
.....................................................
Exact Projection
Exact Projection
Done computation
Print
-2 7
-2 8
-2 9
-2 10
-2 11
-1 6
-1 7
-1 8
-1 9
-1 10
0 5
0 6
0 7
0 8
0 9
1 4
1 5
1 6
1 7
1 8
2 3
2 4
2 5
2 6
2 7
3 2
3 3
3 4
```

image