



Parallel Programming HW3 Report

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19050111017

Using The Makefile

- The **IDIR** variable specifies the path to the include directory, where header files are stored.
- The **CC** variable specifies the compiler to use, which is **mpicc** in this case.
- The **CFLAGS** variable specifies the compiler flags to use, which includes **-I** option for specifying the include directory, **-lstdc++** and **-lmpi_cxx** options for linking the standard C++ library and the MPI C++ bindings, **-g** option for generating debug information, and **-Wall** option for enabling warnings.
- The **ARGS** variable specifies the command line arguments to pass to the program, which is **-n 4** in this case.
- The **ARGS_SIZE** variable specifies the size of the matrix, which is set to **1017 (Large Matrix)** by default.
- The **ARGS_FILENAME** variable specifies the output file name for the program.
- The **TESTARGS** variable specifies the number of processes to use for the MPI test program.

The makefile has the following targets:

- **\$(ODIR)/%.o: %.cpp \$(DEPS)** is a rule for compiling source files into object files. It depends on the corresponding header files and uses the compiler flags specified in **CFLAGS**.
- **19050111017: \$(OBJ)** is a rule for linking object files into an executable. It depends on the object files and uses the compiler flags specified in **CFLAGS**. It also specifies to run the program using **mpirun**.
- **clean** is a rule for cleaning up object files, temporary files, and the executable.

Users can simply type **make** to build and run the program. They can also modify the **ARGS_SIZE** variable to change the size of the matrix and if they want to change process count they can simply modify “**ARGS=-n 4**” this line in makefile.

Large Matrix Timings (Size 1017*1017)

Large Matrix with 1 proccess: Timing is 6389 ms

```
semih@semih-virtual-machine:~/Documents/GitHub/Ceng342/Version_HW3/src$ make
mpicc -c -o obj/19050111017.o 19050111017.cpp -I../include -lstdc++ -lmpi_cxx -g -Wall
mpicc -c -o obj/hellofunc.o hellofunc.cpp -I../include -lstdc++ -lmpi_cxx -g -Wall
mpicc -o ../bin/19050111017 obj/19050111017.o obj/hellofunc.o -I../include -lstdc++ -lmpi_cxx -g -Wall
mpirun -n 1 ../bin/19050111017 1017 1017 Output.txt
My Rank: 0, Num Procs: 1
My rank is: 0 I will compute from row 0 until 1017

filename is: ../bin/Output.txt

-----
Program executed successfully!!
Check the bin folder for the output file.
Elapsed time is 6389.00 milliseconds for parallel mxv with 1 processes
semih@semih-virtual-machine:~/Documents/GitHub/Ceng342/Version_HW3/src$
```

Large Matrix with 4 proccess: Timing is 3105 ms

```
semih@semih-virtual-machine:~/Documents/GitHub/Ceng342/Version_HW3/src$ make
mpicc -o ../bin/19050111017 obj/19050111017.o obj/hellofunc.o -I../include -lstdc++ -lmpi_cxx -g -Wall
mpirun -n 4 ../bin/19050111017 1017 1017 Output.txt
My Rank: 1, Num Procs: 4
My Rank: 2, Num Procs: 4
My Rank: 3, Num Procs: 4
My Rank: 0, Num Procs: 4
My rank is: 2 I will compute from row 508 until 762
My rank is: 1 I will compute from row 254 until 508
My rank is: 0 I will compute from row 0 until 254
My rank is: 3 I will compute from row 762 until 1017

filename is: ../bin/Output.txt

-----
Program executed successfully!!
Check the bin folder for the output file.
Elapsed time is 3105.00 milliseconds for parallel mxv with 4 processes
semih@semih-virtual-machine:~/Documents/GitHub/Ceng342/Version_HW3/src$ make
```

Small Matrix Timings (size 117*117)

Small Matrix with 1 proccess: 470 ms

```
semih@semih-virtual-machine:~/Documents/GitHub/Ceng342/Version_HW3/src$ make
mpicc -o ../bin/19050111017 obj/19050111017.o obj/hellofunc.o -I../include -lstdc++ -lmpi_cxx -g -Wall
mpirun -n 1 ../bin/19050111017 117 117 Output.txt
My Rank: 0, Num Procs: 1
My rank is: 0 I will compute from row 0 until 117

filename is: ../bin/Output.txt

-----
Program executed successfully!!
Check the bin folder for the output file.
Elapsed time is 470.00 milliseconds for parallel mxv with 1 processes
semih@semih-virtual-machine:~/Documents/GitHub/Ceng342/Version_HW3/src$ make
```

Small Matrix with 4 proccess: 93ms

```
semih@semih-virtual-machine:~/Documents/GitHub/Ceng342/Version_HW3/src$ make
mpicc -o ../bin/19050111017 obj/19050111017.o obj/hellofunc.o -I../include -lstdc++ -lmpi_cxx -g -Wall
mpirun -n 4 ../bin/19050111017 117 117 Output.txt
My Rank: 0, Num Procs: 4
My Rank: 1, Num Procs: 4
My Rank: 2, Num Procs: 4
My rank is: 2 I will compute from row 58 until 87
My Rank: 3, Num Procs: 4
My rank is: 3 I will compute from row 87 until 117
My rank is: 1 I will compute from row 29 until 58
My rank is: 0 I will compute from row 0 until 29

filename is: ../bin/Output.txt

-----
Program executed successfully!!
Check the bin folder for the output file.
Elapsed time is 93.00 milliseconds for parallel mxv with 4 processes
```