

CSE344 – System Programming - Signal Handling, Homework 3 Report

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Abstract

Demonstration of the solution of the given the problem of calculating the matrix quarters.

Problem

In our problem, some input methods are defined. If we pass the details of these definitions, our main problem is about the use of pipes. After inputs are handled the we are expected to find the singular values of the product matrix of these matrices given via input. While doing this process, **P1** needs to create child processes for the particles of this job. After creating of children, P1 must assign these jobs to these children. For this, we need to use pipes. After the processes have finished their work, we need them to send the matrix piece found by them, to P1 again to be joined by P1. Therefore, bi-directional pipe design should be considered.

Solution

In our problem, what was ultimately expected from us was to obtain the singular values of the matrix formed as a result of the product of two given matrices. In order to make this work a bit more efficient, we had to divide the matrices into four before multiplying the matrices and assign these matrices to 4 different child processes. Of course, here, inter-process communication is required. For this reason, it was actually wise to use **pipe** feature that can solve our job in the most light-weight and simple way. First, a model structure was needed to represent the matrices. And for this reason, a very simple matrix structure and some other necessary models have been defined. We have done the input and output codes. Of course, after that, we have to realize that the pipes must be bi-directional. Because they need not only take the part of the matrix but also they need to calculate it, then to send the part they compute to the parent process. For this, the pipes had to be bi-directional. Then, after having grasped the idea in theory, another important part was that, as with all communication systems, the internal packets we would send needed a specific protocol. Therefore, the functions of these packages have been set very simply and two functions called **unpack** and **pack** have been defined. Then the synchronization processes in the reading and writing processes became easier with our choice of using pipes, i.e. with choosing this as our synchronization barrier.

Let's show couple of tests here, (starting from the next page.) In shared tests, you can observe at which stage the processes are and how the workflows are realized.

```
drh0use@wife: ~/Downloads/sys/hw3/source
drh0use@wife:~/Downloads/sys/hw3/source$ ./program -f input1.txt -s input2.txt -
n 2

[ P1 ] Starting...
[ P1 ] Writed operands to Q0.
[ Q0 ] Starting...
[ Q0 ] Finished reading operands from pipe.
[ Q0 ] Quarter calculated.
[ Q0 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q0 ] Exiting...
[ P1 ] Writed operands to Q1.
[ Q1 ] Starting...
[ Q1 ] Finished reading operands from pipe.
[ Q1 ] Quarter calculated.
[ P1 ] Writed operands to Q2.
[ Q2 ] Starting...
[ Q1 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q1 ] Exiting...
[ Q2 ] Finished reading operands from pipe.
[ Q2 ] Quarter calculated.
[ Q2 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q2 ] Exiting...
[ P1 ] Writed operands to Q3.
[ P1 ] Finished assigning quarters. Collecting quarters...
```

Figure 1

```
drh0use@wife: ~/Downloads/sys/hw3/source
[ Q2 ] Finished reading operands from pipe.
[ Q2 ] Quarter calculated.
[ Q2 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q2 ] Exiting...
[ P1 ] Writed operands to Q3.
[ P1 ] Finished assigning quarters. Collecting quarters...
[ Q3 ] Starting...
[ Q3 ] Finished reading operands from pipe.
[ Q3 ] Quarter calculated.
[ Q3 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q3 ] Exiting...
[ P1 ] Collected all quarters. OK.

{      [mat: 4x4]
| 19794.000 20717.000 20092.000 21485.000 |
| 21362.000 22357.000 21684.000 23185.000 |
| 20275.000 21189.000 20585.000 21960.000 |
| 20962.000 21967.000 21266.000 22780.000 |
}
Singular Values:      85494.773 53.050 0.127 5.673
[ P1 ] Exiting...
drh0use@wife:~/Downloads/sys/hw3/source$
```

Figure 2

```
drh0use@wife: ~/Downloads/sys/hw3/source
drh0use@wife:~/Downloads/sys/hw3/source$ ./program -f input1.txt -s input2.txt -n 3

[ P1 ] Starting...
[ Q0 ] Starting...
[ P1 ] Writed operands to Q0.
[ Q0 ] Finished reading operands from pipe.
[ Q0 ] Quarter calculated.
[ Q0 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q0 ] Exiting...
[ P1 ] Writed operands to Q1.
[ Q1 ] Starting...
[ Q2 ] Starting...
[ Q1 ] Finished reading operands from pipe.
[ Q1 ] Quarter calculated.
[ P1 ] Writed operands to Q2.
[ Q1 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q1 ] Exiting...
[ Q2 ] Finished reading operands from pipe.
[ Q2 ] Quarter calculated.
[ Q2 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q2 ] Exiting...
[ Q3 ] Starting...
[ P1 ] Writed operands to Q3.
[ P1 ] Finished assigning quarters. Collecting quarters...
[ Q3 ] Finished reading operands from pipe.
[ Q3 ] Quarter calculated.
[ Q3 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q3 ] Exiting...
[ P1 ] Collected all quarters. OK.

{      [mat: 8x8]

| 43943.000 41677.000 42866.000 43773.000 45339.000 38934.000 41654.000 44849.000 |
| 43965.000 41770.000 42893.000 43852.000 45415.000 38813.000 41801.000 44898.000 |
| 43372.000 41177.000 42381.000 43283.000 44794.000 38832.000 41185.000 44355.000 |
| 43614.000 41417.000 42497.000 43433.000 44928.000 38556.000 41367.000 44553.000 |
}
```

Figure 3

```
drh0use@wife: ~/Downloads/sys/hw3/source

[ Q1 ] Starting...
[ Q2 ] Starting...
[ Q1 ] Finished reading operands from pipe.
[ Q1 ] Quarter calculated.
[ P1 ] Writed operands to Q2.
[ Q1 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q1 ] Exiting...
[ Q2 ] Finished reading operands from pipe.
[ Q2 ] Quarter calculated.
[ Q2 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q2 ] Exiting...
[ Q3 ] Starting...
[ P1 ] Writed operands to Q3.
[ P1 ] Finished assigning quarters. Collecting quarters...
[ Q3 ] Finished reading operands from pipe.
[ Q3 ] Quarter calculated.
[ Q3 ] Quarter sent. Sending SIGCHLD to parent. OK.
[ Q3 ] Exiting...
[ P1 ] Collected all quarters. OK.

{      [mat: 8x8]

| 43943.000 41677.000 42866.000 43773.000 45339.000 38934.000 41654.000 44849.000 |
| 43965.000 41770.000 42893.000 43852.000 45415.000 38813.000 41801.000 44898.000 |
| 43372.000 41177.000 42381.000 43283.000 44794.000 38832.000 41185.000 44355.000 |
| 43614.000 41417.000 42497.000 43433.000 44928.000 38556.000 41367.000 44553.000 |
| 44230.000 41869.000 43038.000 43987.000 45540.000 39651.000 41892.000 45102.000 |
| 38971.000 36491.000 37944.000 38515.000 40331.000 33860.000 36800.000 39189.000 |
| 43850.000 41597.000 42731.000 43737.000 45172.000 39274.000 41575.000 44893.000 |
| 44090.000 42004.000 43159.000 44044.000 45464.000 39769.000 41989.000 45272.000 |
}
Singular Values:      338386.188 1106.369 410.713 150.856 83.156 66.275 1.825 40.817
[ P1 ] Exiting...
drh0use@wife:~/Downloads/sys/hw3/source$
```

Figure 4