

ECE 576 – Engineering of Computer Based Systems

Homework Assignment 2

Due Thursday, March 26 (*beginning of lecture*) and Friday, March 27 (*via email by 11:59PM*)

1. (20 points) Partition the following C code to a loosely-coupled coprocessor design. Using the profile information annotated within C code, determine which of the two innermost loops will result in the best increase in performance when partitioned to a hardware coprocessor. Partition the selected innermost loop to hardware and estimate the speedup of the partitioned design over software only execution. (*Due Thursday, March 26 beginning of lecture*)

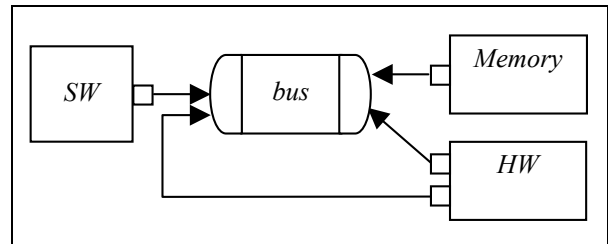
```
int main() // Total Cycles: 8193437
{
    int n;
    int i,j,k;

    for (n = 0 ; n < LOOPS ; n++) // Total Cycles: 8186006, Execs: 1, ITERS: 1000
    {
        for(i=1;i<=SIZE;i++) // Total Cycles: 579000, Execs: 1000, ITERS: 5
            for(j=1;j<=SIZE;j++) // Total Cycles: 520000, Execs: 5000, ITERS: 5
                c[i][j] = 0;

        for(i=1;i<=SIZE;i++) // Total Cycles: 7579000, Execs: 1000, ITERS: 5
            for(j=1;j<=SIZE;j++) // Total Cycles: 7520000, Execs: 5000, ITERS: 5
                for(k=1;k<=SIZE;k++) // Total Cycles: 7225000, Execs: 25000, ITERS: 5
                    c[i][j] += a[i][k] * b[k][j];
    }

    return 0;
}
```

2. (20 points) Using SystemC and transaction-level modeling, create an approximate timed model of the resulting hardware/software partitioning implementation. The diagram to the right provides a suggested TLM implementation identifying the computation components, communication channel, interfaces, and connections. (*Due Friday, March 27 via email by 11:59PM*)



Implementation Notes: Memory contents for a and b arrays:

```
a = { 0,0,0,0,0,0,0,0,9,4,7,9,0,12,14,15,16,11,0,2,3,4,5,6,0,4,3,2,1,2,0,2,7,6,4,9 };
b = { 0,0,0,0,0,0,0,0,9,4,7,9,0,12,14,15,16,11 0,2,3,4,5,6,0,4,3,2,1,2,0,2,7,6,4,9 };
```

Submission requirements: You must submit your SystemC files via email as a single ZIP attachment by Friday, March 27 no later than 11:59PM. The timestamp of your email in **my** Inbox will be used for this purpose. When in doubt, submit your homework assignment early. *Note: Please do not submit executables, Makefiles, or Visual Studio project files.*

Linux Server requirements: The server *embedded.ece.arizona.edu* is available for development and testing of your design. If you want to use the embedded server, please email the instructor to allow for a directory to setup for your development efforts. Otherwise, students can utilize the departmental servers and workstations for their projects, and are free to use Microsoft Visual Studio, if desired. If you choose to use Microsoft Visual Studio, you will need to compile the SystemC library, for which many tutorials exist. *Note: Again, please do not submit executables, Makefiles, or Visual Studio project files.*