ELE 455/555

Spring 2016

Homework 3

Due 2/9

Beginning of Class

1. Part Cost – 10pts

Estimate the cost of a new processor given the following:

Wafer cost: $2500
Raw wafer yield: 95%
Defect density: 0.15defects/cm2
$\alpha = 15, Y_0 = 1$
Package Cost: $0.003/ball
Packaged part yield:99%

Die size: 95mm2
Parametric yield: 99%
Package: 32x32 ball BGA
Desired margin: 40%
200mm wafer
Use default spacing etc for wafer estimator

2) Processor Performance - 10pts

Calculate the execution time for each of the processors below

Processor	Clock Rate (GHz)	CPI	Instruction Count (Millions)	Execution Time (ms)
1	4	1.1	45	
2	3.5	1	40	
3	3	0.9	35	
4	2.5	1	30	

Which processor executes the fastest?

Multiprocessor Performance – Table MP

Multiprocessor performance is measured as a combination of computing time and inter-processor communication time. The following table indicates the benchmark times associated with several routines and routing time for a number of processors.

Number of Processors	Routine 1 (ms)	Routine 2 (ms)	Routine 3 (ms)	Routine 4 (ms)	Routine 5 (ms)	Routing Time (ms)
2	80	18	12	70	39	12
4	58	4	9	36	30	14
8	30	6	9	19	22	18
16	14	2	6	11	17	23
32	8	2	1	6	11	24
# Instructions (millions)	144	27	16	72	35	-

3. Multiprocessor Performance Comparison – 10pts

Using table MP: Plot the execution time for these processor configurations
Execution time (all 5 routines combined) vs # of processors (1 curve)

If processors cost $0.10 each and each ms of execution time costs $0.01 each. What configuration minimizes the system cost.

4. Multiprocessor Performance Comparison – 10pts

Using table MP: Assume a 1GHz clock

Plot the CPI for routines 1 and 4 for each of the processor configurations

CPI vs # of processors – (2 curves- routines 1,4)

5. Performance Comparison – 10pts

Which of these laptops offers the best processor performance

1) Samsung – NP470R5E-K01UB
2) Toshiba – P55-A5312
3) HP – m6-k022dx

6) MIPS Assembly – 10pts

Convert the following C to MIPS assembly:

A[5] = B[3] + A[5]

Assume $s1 and $s2 hold the base address for A and B

7) MIPS Assembly – 10pts

Convert the following C to MIPS assembly:

A[j + k] = B[j - k]

Assume $s1 and $s2 hold the base address for A and B
Assume $s3 and $s4 hold the values for j and k

8) MIPS Assembly – 10pts

Convert the following assembly to MIPS machine code:

```
add     $t0, $s6, $s5
addi    $t1, $s3, -18
```

9) MIPS Assembly – 10pts

Convert the following MIPS machine code to assembly:

```
0x15150002      // assume these 4 instructions are in order

0x22730001

0x01364820

0x00094840
```

10) MARS – 10pts

Download the MARS simulator (java app) and run the Fibonacci code. Add to the code a line that places the last 4 digits of your UID into S7 in hex format (e.g. UID =12345678, would appear as 0x00005678). Screen dump the completed simulation.