York University
COSC4201
Midterm Oct.
Nov. 1st , 2004

Last Name _____ First name _____

ID _____

Problem	Points
1	/5
2	/5
3	/5
4	/10
5	/5
Total	/30

Problem 1 (5 points)
Identify all the dependencies in the following codes, draw circles and arrows to show them, and label the arrow with the name of the dependency.

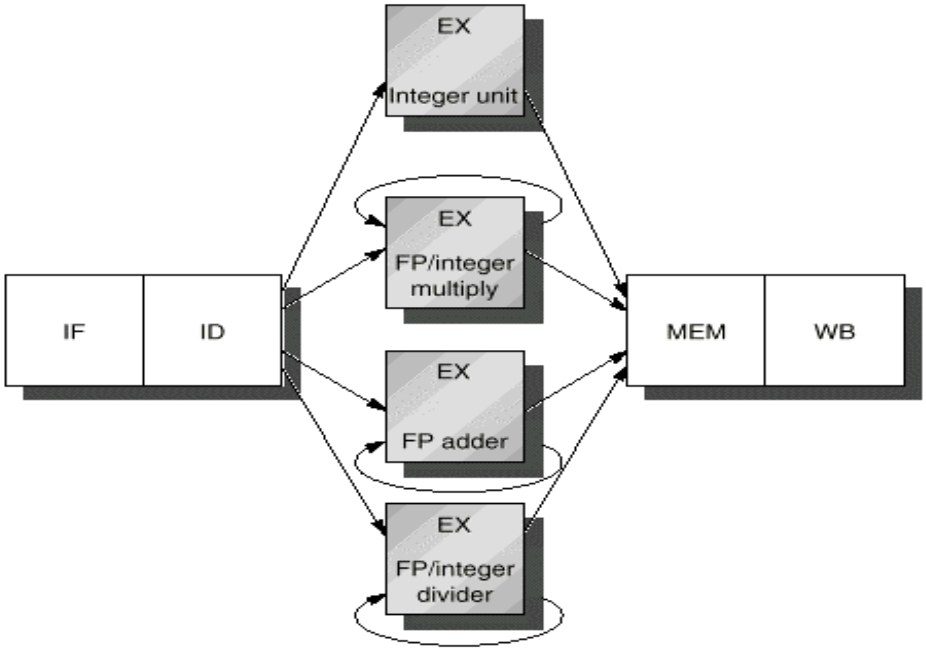
```
R1 = R1 + R3


R4 = R1 + R5


R1 = R7 + 2


R3 = R6 + R9
```

Problem 2 (3 points)
Assume that is a MIPS-like CPU, not taken branches do not cause any stalls. The delay slot of the branch is filled by an instruction from the untaken path only, and will not execute if the branch is taken. If you know that 20% of the instructions are branches, 85% of which are taken. What is the CPI of that machine if we can schedule 60% of the branch delay slots, and the CPI without branches is 1?

Problem 3 (3 points)
Machine A is 20% faster than machine B for a specific program. Careful analysis of the program shows that Machine A spends 40% of it time on FP multiplication, while machine B spends 60% of its time on FP multiplication. An optimization of the multiplier results in making machine A faster by 15%, and machine B faster by 25%. After the optimization, which machine is faster? By how much?

Problem 4 (5 points)

Consider a pipeline like the one shown below, with the following corresponding latencies.



Function Unit	latency	initiation period
Integer ALU	0	1
Data Memory	1	1
FP add	3	1
FP Multiply	6	1
FP Divide	24	24

If the following code is executed.

```
Foo: LD        F2,0(R1)
     MULD      F4,F2,F0
     LD        F6,0(R2)
     ADD       F6,F4,F6
     STORE     0(R2)F6
```

For each instruction, show the time at which it starts execution, and the time it ends execution (by execution I mean the EX stage).

Problem 5 (5 points)

Consider the following code. Using scoreboard, determine what time each instruction is issued, read its operands, complete execution, and write the results. Assume that the CPU has one FP multiplier and 2 FP adder/subtractor

```
MUL     F0, F6, F4
SUB     F8, F0, F2
ADD     F2, F10, F2
```