Marcus Domingo

HW8B

**CSC205 section 1 Spring 2015 Homework 8**

**How to Submit:**

**Please submit your solutions (parts A and B separately) through Blackboard. Remember to put your name and homework number on all the documents that you submit as attachments.**

**Total possible points in this homework: 5 for Part B**

**(You receive 1 bonus point towards Part A if you get all Part A questions correct.)**

# Part B

2. [Total 5 pts] In this question, we explore synchronous pipeline efficiency in less-than ideal scenarios. Let *t* be the typical length of a single task without pipelining. Let P2 be a pipeline with 2 stages, and P4 be a pipeline with 4 stages.

1. [1pt] Find the maximum efficiency of P2 and of P4 if they are ideal.

P2:

Efficiency = t/b

b = (t/k) + overhead

Efficiency = t/((t/k)+overhead))

Overhead = 0t

Efficiency = t/0.5t

Efficiency = 2

P4:

Efficiency = t/b

b = (t/k) + overhead

Efficiency = t/((t/k)+overhead))

Overhead = 0t

Efficiency = t/0.25t

Efficiency = 4

1. [1pt] Suppose the overhead of pipelining is 0.2\**t* per stage, and this cost is independent of the number of stages. Find the maximum efficiency of P2 and of P4 with overhead.

P2:

Efficiency = t/b

b = (t/k) + overhead

Efficiency = t/((t/k)+overhead))

Overhead = 0.2t

Efficiency = t/(0.5t + 0.2t)

Efficiency = t/0.7t

Efficiency = 10/7

P4:

Efficiency = t/b

b = (t/k) + overhead

Efficiency = t/((t/k)+overhead))

Overhead = 0.2t

Efficiency = t/(0.25t + 0.2t)

Efficiency = t/0.45t

Efficiency = 20/9

1. [1pt] Suppose a pipeline hazard requires an idle stage to be added. Evaluate the maximum efficiency of P3 (which is P2 with an idle stage) and P5 (which is P4 with an idle stage) with an overhead of 0.2\**t* per stage.

P3 = P2 efficiency because the idle stage would make the number of stages k-1 which 3-1=2.

P4 = P5 efficiency because the idle stage would make the number of stages k-1 which 5-1=4.

1. [1pt] Based on your observations on (b) and (c), provide insight on how to design an effective synchronous pipeline.

Adding in an idle stage to avoid pipeline hazard can be done because it doesn’t change the efficiency of the pipline.

1. [1pt] Pipeline hazards, in the worst case, cause the pipeline to flush and reset. Propose a model to evaluate the efficiency of a pipeline in this scenario.

Looking at the scenario as encountering an if/else statement where the data can either continue going through the stages or jump to a stage further in the pipeline we can use an equation Efficiency = .5(t/b) which essentially just means there is a 50/50 chance that the pipeline would flush and reset there for the efficiency is half the original efficiency.

Though not directly related to this question, the following discussion can cast some interesting light on the devastating effect of conditional branching in a real-world encounter. “Why is processing a sorted array faster than an unsorted array?” (http://stackoverflow.com/questions/11227809/why-is-processing-a-sorted-arrayfaster-than-an-unsorted-array?rq=1)