**BCT 2408 Lab1  
Enoch Teddy  
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E1: H&P**

The optimized version is faster.  
**Execution Time Comparison:**

* **Unoptimized version**: TimeU=1I/1.05R≈0.952 I/R
* **Optimized version**: TimeO=0.9I/1R=0.9 I/R

Since 0.9<0.9520, the optimized it faster overall.

**E2: H&P  
Part 1: Percentage of Loads to Eliminate**

**Given:**

* Original instruction count IC.
* 22.8% of instructions are loads: 0.228IC.
* Replacing loads reduces instruction count by 1 per replaced load.
* Clock period increases by 5% → Clock rate: 1/1.05×original

For equal performance:

(IC−0.228x ⋅ IC/ (1/1.05) )≤ IC ⟹  (1−0.228x)×1.05≤1

**Solving for x:**  
(1−0.228x)×1.05≤1   
1−0.228x≥1/1.05≈0.9524  
0.228x≥0.04760  
x≥0.0476/0.228=0.209 or 20.9%

At least **20.9% of loads** must be eliminated to maintain equal performance.

**Part 2: Non-Replaceable Example**

Code Example:

LOAD Rx, 0(Rb) ; Load Rx from memory

ADD Ry, Ry, Rx ; Use Rx immediately

ADD Rz, Rz, Rx ; Use Rx again later

* Replacing the first two instructions with ADD Ry, 0(Rb) would **skip loading Rx**, leading to incorrect behavior.
* The third instruction (ADD Rz, Rz, Rx) would use an invalid value of Rx, since Rx was not loaded properly.

This demonstrates that **not all sequences of instructions can be optimized** by replacing multiple instructions with a single one as proposed in the new instruction.