Branch Prediction and Predication

Architecture Parameters:

CPU Type: **Out-of-Order CPU**

Clock Frequency: **3GHz**

Memory Type: **DDR3 1600 8x8**

L1 Instruction Cache: **16 KB**

L1 Data Cache: **64 KB**

L2 Cache: **256 KB**

Tutorial Link: https://tinyurl.com/yjlja5r8

1. Average execution time (10 executions) of **choose.c** with two variations:
    i. **Branch** —> **353.5 milli seconds**
       Standard Deviation, σ: **35.738**
    ii. **CMOV** (Predication) —> **436.6 milli seconds**
       Standard Deviation, σ: **44.161**
       Execution of choose.c in Gem5 with input 10^6
    a. **Branch** -> **3502428732** ticks for execution
       # of branches predicted: **2085352**
       Number of times a branch was mispredicted: **6575**
    b. **CMOV** -> **3505179645**
       # of branches predicted: **1087188**
       Number of times a branch was mispredicted: **7011**
2. Average execution time (10 executions) of **graph.cpp** on **x86 processor** with "**large**" input:
    a. **Branch** -> **2 minutes 30 seconds**
       Standard Deviation, σ: **13.55 seconds**
    b. **CMOV** -> **1 minute 8 seconds**
       Standard Deviation, σ: **2.75 seconds**
    Execution of **graph.cpp** in **Gem5** with "**small**" and "**medium**" input:
    Small:
       Branch Variant:
       Predicted Branches: **451136**
       % of incorrect branches: **2.018%**
       CMOV Variant:
       Predicted Branches: **227792**
       % of incorrect branches: **1.208%**
    Medium:
       Branch Variant:
       Predicted Branches: **1275326**
       % of incorrect branches: **2.113%**
       CMOV Variant:
       Predicted Branches: **472135**
       % of incorrect branches: **1.118%**