1. A.

and $x5, $x5, $x0 #let i = 0

add $x6, $x0, $x13 #temp = dimension

LOOP: sw $zero, 0($x12) #a[i] = 0

addi $x5, $x5, 1 #i = i + 1

bne $x6, $x5, LOOP #if i < dimension

B.

If the value of dimension is 512, then there will be (512 \* 3) + 2 = **1538** dynamic instructions executed.

C.

Text

Description automatically generated

D.

Text

Description automatically generated

E.

Without optimization, if the dimension is 512, 8 + (10 \* 512) + 5 = **5133** dynamic instructions executed.

With optimization, if the dimension is 512, (10 \* 512) + 3 = **5123** dynamic instructions executed.

1. A.

ET = IC \* CPI \* CR

We will set IC = 1 since they are equal for all three processors so does not affect which one has highest performance.

P1: = 5 \* 10-10 seconds/program

P2: = **4 \* 10-10 seconds/program**

P3: = 5.5 \* 10-10 seconds/program

**Since P2 has the least seconds per program, it has the highest performance.**

B.

**P1:** = **2 \* 1010 instructions in program**

2 \* 1010 instructions \* 1.5 cycles/instruction = **3 \* 1010 cycles in program**

**P2:** = **2.5 \* 1010 instructions in program**

* 1. \* 1010 instructions \* 1.0 cycles/instruction = **2.5 \* 1010 cycles in program**

**P3:** = **1.82 \* 1010 instructions in program**

1.82 \* 1010 instructions \* 1.0 cycles/instruction = **4.004 \* 1010 cycles in program**

C.

Reduce execution time by 30%:

P1: 5 \* 10-10 seconds/program \* .7 = 3.5 \* 10-10 seconds/program

P2: 4 \* 10-10 seconds/program \* .7 = 2.8 \* 10-10 seconds/program

P3: 5.5 \* 10-10 seconds/program \* .7 = 3.85 \* 10-10 seconds/program

Increase CPI by 20%:

P1: 1.5 \* 1.2 = 1.8

P2: 1.0 \* 1.2 = 1.2

P3: 2.2 \* 1.2 = 2.64

Clock Rate:

Set IC as 1 again

P1: = **5.14 GHz**

P2: = **4.29 GHz**

P3: = **6.85 GHz**

1. A.

Average CPI = (1 \* .6) + (12 \* .3) + (5 \* .1) = **4.7 cycles/instruction**

B.

ET = = **11.75 seconds**