

CE/CZ3001: Advanced Computer Architecture

Tutorial-2

1. Consider a processor working at its maximum operating clock frequency of 300 MHz at operating voltage of 3.0 volts. If the operating voltage of the processor is increased to 3.3 volts, find the % change in the following:
 - (i) Dynamic power consumption
 - (ii) Static power consumption
 - (iii) Performance
 - (iv) Energy consumption for any given program.

Assume that the maximum operating clock frequency is proportional to operating voltage. Discuss the impact of increase of voltage in the following two cases:

Case-1: When you opt to increase the operating frequency to maximum usable frequency which is achievable after the increase of voltage.

Case-2: When you do not change the operating frequency after the increase in voltage

Based on the impacts of increase in voltage, analyse the impact of reduction of operating voltage.

(Answer Case-1: (i) increase 33.1%, (ii) increase 10%, (iii) increase by a factor of 1.1, (iv) increase 21% for dynamic energy consumption and no change for static energy consumption)
(Answer Case-2: (i) increase 21%, (ii) increase 10%, (iii) no change, (iv) increase 21% for dynamic energy consumption and increase 10% for static energy consumption)

2. Let a and b be two arrays of integers stored in the memory. The base address of a is in register X10 and the base address of register b is in X11. Array a is calculated from arrays b according to the following C program:

$$\text{for } (i=0; i \leq 100; i=i+1) \\ a[i] = b[i] + c;$$

register X1 stores the value of constant c .

- (i) Write the LEGv8 code for the given C program.
- (ii) How many instructions are executed for running this code?
- (iii) How many memory references for data are made during execution?

(Answer: (i) , (ii) 708, (iii) 202.)