►Solution◄

Question 1: (10 points)

Google has just hired you for a summer internship to work in the YouTube team. As an intern, your first job is to understand the performance of an in-house 2 GHz processor that Google uses to compress digital video data into Google's open and royalty free VP9 video compression format. Assuming that the compression job requires 1 billion instructions in total and includes the following distribution of instructions:

Instruction	% of total Instructions	CPI
Integer	10	1
Floating point	20	3
Load	30	2
Store	20	1
Branches	15	4
Other	5	1.5

a. (5 points) Compute the average CPI for this video encoder.

Solution:
$0.2 \times 3 + 0.1 \times 1 + 0.3 \times 2 + 0.2 \times 1 + 0.15 \times 4 + 0.05 \times 1.5 = 2.175$ CPI

b. (5 points) How long does it take the encoder to execute?

Solution:
$10^9 \times 2.175 \times (1/(2 \times 10^9)) = 1.0875$ seconds