Important Notes:

1. You have 75 minutes for answering the following questions. There are 3 questions. Q1 and Q3 are worth 30 points while Q2 is worth 40 points.

2. Be concise and accurate in your answers. If you don't know the answer to a question, the best strategy is to move on, and return to the question later.

3. Please answer the questions in the space provided below each question. If you need additional space, use the blank page at the end. However, you can use your own paper for rough work if necessary.

Q1. Consider two different implementations, M1 and M2, of the same instruction set. There are four classes of instructions (A, B, C, and D) in the instruction set. M1 has a clock rate of 500 MHz. The average number of cycles for each instruction class on M1 is as follows:

Class	CPI for this class
A	1
B	2
C	3
D	4

M2 has a clock rate of 750 MHz. The average number of cycles for each instruction class on M2 is as follows:

Class	CPI for this class
A	2
B	2
C	4
D	4

If the number of instructions executed in a certain program is divided equally among the classes of instructions above, how much faster is M2 than M1?

A1.

Q2. Consider the following segment of C code:

```
for (i = 0; i <= 100; i=i+1) { a[i] = b[i] + c; }
```

Assume that `a` and `b` are arrays of words and that the base address of `a` is in $a0 and the base address of `b` is in $a1. Register $t0 is associated with the variable `c`. Write the MIPS assembly code for this C code fragment. How many instructions will be executed during the running of this code? How many memory references will be made during the execution? [HINT: both instructions and data are stored in memory].

A2.

Q3. Give two reasons why the architects of MIPS did not provide a special instruction that was capable of loading a 32 bit constant into a register? How is a 32 bit constant loaded into a register in MIPS?

A3.