CPSC 418	Advanced Computer Architecture	Spring 1996
	Midterm: 8 Feb	

General Information

- 100 points total
- Closed book, closed notes
- Time limit: 1 hour, 15 minutes

- **Show all relevant work**:
  - Write neatly
  - Write out all formulas with variables, then substitute in numerical values and evaluate the formula
  - Document the meaning of all of the variables you use

Name:____

Student Id Number:________________________________

Problem 1 (5 Points)

List 3 of the 5 highest performance microprocessors currently being sold. *Be sure to list both the company and the model.* (For example Zilog Z80, Motorola 68010, and Inmos T90)

Problem 2 (10 Points)

2(a) (5 Points) *Briefly* support or refute the statement that "the number of instructions is one of the most important differences between CISC and RISC architectures".

2(b) (5 Points) List two of the *most important* differences between CISC and RISC architectures.

Problem 3 (10 Points)

3(a) (7 Points) Given a computer with four interrupt levels (IL0 – IL3), assign interrupt/trap levels to the following devices/routines:

Keyboard
Reset/Reboot Button
Disk Drive
Network Interface
Mouse
Memory Allocation

3(b) (3 Points) Is there any device or O/S routine that should be at a higher interrupt level than the highest level you used above? *Justify your answer.*

Problem 4 (10 Points)

To keep up with the market (*i.e.* other companies), system performance needs to double every two years. You are considering a design improvement that will increase performance by 19% but delay the release date of a system by six months.

In terms of the performance of the system with respect to other machines that will be on the market when it will be released, is it better to release the system on its current schedule, or to add the improvement and move back the release by six months?

Problem 5 (10 Points)

The function `f` has the following parameters:

input params:

name	constant or variable	type
AS	constant	array of strings
I1	constant	integer
F1	constant	float
I2	variable	integer
AI	variable	array of integers
F2	variable	float

result: R : array of integers

where "constant or variable" says whether assignments to the parameter within `f` also effect the parameter in `main` (*e.g.* variable = `var` in Pascal or & in C).

Using the Feldman and Retter (F&R) conventions, say whether a copy of the parameter must be made before calling `f`, specify what exactly is passed and where it is passed.

name	const/var	type	make copy? (Yes/No)	how passed	location
EXAMPLE	—	—	Yes	value	R5
AS	constant	array of strings			
I1	constant	integer			
F1	constant	float			
I2	variable	integer			
AI	variable	array of integers			
F2	variable	float			
R	RESULT	array of integers			

Problem 6 (15 Points)

List the events, in the order that they happen, that occur when a user hits a key on the keyboard. *Your list should contain at least ten items.*

Problem 7 (20 Points)

Given two microprocessors, Rabbit and Turtle, and the following data:

CPU	Rabbit	Turtle
Clock speed	300MHz	100MHz
ICache size	16Kb	8Kb
DCache size	16Kb	8Kb
Number of inst issue units	2	4
Avg number of instructions issued per cycle	1.17	3.25
Number of instructions per trace	$1.1 * \#Inst_T$	$Inst_T$
Number of transistors	$9.3 * 10^6$	$7.5 * 10^6$

7(a) (5 Points) What are the CPIs of Rabbit and Turtle?

7(b) (15 Points) Which CPU is faster and how much faster is it?

Problem 8 (20 Points)

One of the differences between Feldman and Retter's instruction set architecture and more conventional ones is that F&R use word addressing and not byte addressing.

In C, if `p` is a pointer to an element in some array, `p++` increments `p` so that its value is the address of the next element in the array.

8(a) (6 Points) Write the F&R assembly code for `p++` when `p` points to a 32-bit integer. *Document your code.*

8(b) (6 Points) Write the F&R assembly code for `p++` when `p` points to an 8-bit byte. *Document your code.*

8(c) (4 Points) List two advantages and two disadvantages of word addressing.

8(d) (4 Points) Do you think word addressing is better than byte addressing? *Justify your answer.*