

LAST (Family) NAME: _____

FIRST (Given) NAME: _____

STUDENT NUMBER: _____

UNIVERSITY OF TORONTO
Faculty of Arts & Science
DECEMBER 2018 EXAMINATIONS
CSC258H1F

Duration: 3 hours
Aids Allowed: 1 ruler, 1 highlighter

Exam Reminders:

- Fill out your name and student number on the top of this page and at the bottom of subsequent pages.
- Do not begin writing the actual exam until the announcements have ended and the Exam Facilitator has started the exam.
- As a student, you help create a fair and inclusive writing environment. If you possess an unauthorized aid during an exam, you may be charged with an academic offence.
- Turn off and place all cell phones, smart watches, electronic devices, and unauthorized study materials in your bag under your desk. If it is left in your pocket, it may be an academic offence.
- When you are done your exam, raise your hand for someone to come and collect your exam. Do not collect your bag and jacket before your exam is handed in.
- If you are feeling ill and unable to finish your exam, please bring it to the attention of an Exam Facilitator so it can be recorded before leaving the exam hall.
- In the event of a fire alarm, do not check your cell phone when escorted outside.

Special Instructions:

- There are 6 questions on 14 pages, plus a bonus question. When you hear the signal to start, make sure that your exam is complete before you begin.
- Read over the entire exam before starting.
- If you use any space for rough work or have to use the overflow page, clearly indicate the section(s) that you want marked.

Exam Format and Grading Scheme:

Part A:	/ 19	Part B:	/ 25	Part C:	/ 22	Part D:	/ 39
Part E:	/ 14	Part F:	/ 24	Bonus:	/ 1	Total:	/ 143

Students must hand in all examination materials at the end

Reference Information

ALU Arithmetic Input Table:

Select		Input	Operation	
S ₁	S ₀	Y	C _{in} =0	C _{in} =1
0	0	All 0s	G=A	G=A+1
0	1	B	G=A+B	G=A+B+1
1	0	B	G=A-B-1	G=A-B
1	1	All 1s	G=A-1	G=A

Register assignments:

Register values : Processor role

- Register 0 (\$zero): reserved value.
- Register 1 (\$at): reserved for the assembler.
- Registers 2-3 (\$v0, \$v1): return values
- Registers 4-7 (\$a0-\$a3): function arguments
- Registers 8-15, 24-25 (\$t0-\$t9): temporaries
- Registers 16-23 (\$s0-\$s7): saved temporaries
- Registers 28-31 (\$gp, \$sp, \$fp, \$ra)

Assembly Instruction Table:

Instruction	Type	Op/Func	Syntax
add	R	100000	\$d, \$s, \$t
addu	R	100001	\$d, \$s, \$t
addi	I	001000	\$t, \$s, i
addiu	I	001001	\$t, \$s, i
div	R	011010	\$s, \$t
divu	R	011011	\$s, \$t
mult	R	011000	\$s, \$t
multu	R	011001	\$s, \$t
sub	R	100010	\$d, \$s, \$t
subu	R	100011	\$d, \$s, \$t
and	R	100100	\$d, \$s, \$t
andi	I	001100	\$t, \$s, i
nor	R	100111	\$d, \$s, \$t
or	R	100101	\$d, \$s, \$t
ori	I	001101	\$t, \$s, i
xor	R	100110	\$d, \$s, \$t
xori	I	001110	\$t, \$s, i
sll	R	000000	\$d, \$t, a
sllv	R	000100	\$d, \$t, \$s
sra	R	000011	\$d, \$t, a
srav	R	000111	\$d, \$t, \$s
srl	R	000010	\$d, \$t, a
srlv	R	000110	\$d, \$t, \$s
beq	I	000100	\$s, \$t, label
bgtz	I	000111	\$s, label
blez	I	000110	\$s, label
bne	I	000101	\$s, \$t, label
j	J	000010	label
jal	J	000011	label
jalr	R	001001	\$s
jr	R	001000	\$s
lb	I	100000	\$t, i(\$s)
lbu	I	100100	\$t, i(\$s)
lh	I	100001	\$t, i(\$s)
lhu	I	100101	\$t, i(\$s)
lw	I	100011	\$t, i(\$s)
sb	I	101000	\$t, i(\$s)
sh	I	101001	\$t, i(\$s)
sw	I	101011	\$t, i(\$s)
slt	R	101010	\$d, \$s, \$t
sltu	R	101001	\$d, \$s, \$t
slti	I	001010	\$t, \$s, i
sltiu	I	001011	\$t, \$s, i
mfhi	R	010000	\$d
mflo	R	010010	\$d
trap	I	001100	i