

University of Illinois at Urbana-Champaign First Midterm Exam, ECE 220 Honors Section

Thursday 15 February 2018

Name:

Net ID:

- Be sure that your exam booklet has ELEVEN pages.
- Write your name and Net ID on the first page.
- Do not tear the exam apart other than to remove the reference sheet.
- This is a closed book exam. You may not use a calculator.
- You are allowed one handwritten 8.5×11-inch sheet of notes (both sides).
- The last page of the exam gives RTL for LC-3 instructions (except JSRR). Copies of Patt & Patel's Appendix A are also available during the exam.
- Absolutely no interaction between students is allowed.
- Show all work, and clearly indicate any assumptions that you make.
- Don't panic, and good luck!

Problem 1 24 points _____

Problem 2 20 points _____

Problem 3 20 points _____

Problem 4 16 points _____

Problem 5 20 points _____

Total 100 points _____

NOTES: RTL corresponds to execution (after fetch!); JSRR not shown

ADD	<table border="1"><tr><td>0001</td><td>DR</td><td>SR1</td><td>0</td><td>00</td><td>SR2</td></tr></table>	0001	DR	SR1	0	00	SR2	ADD DR, SR1, SR2	LD	<table border="1"><tr><td>0010</td><td>DR</td><td></td><td></td><td></td><td>PCoffset9</td></tr></table>	0010	DR				PCoffset9	LD DR, PCoffset9
0001	DR	SR1	0	00	SR2												
0010	DR				PCoffset9												
	DR ← SR1 + SR2, Setcc		DR ← M[PC + SEXT(PCoffset9)], Setcc														
ADD	<table border="1"><tr><td>0001</td><td>DR</td><td>SR1</td><td>1</td><td></td><td>imm5</td></tr></table>	0001	DR	SR1	1		imm5	ADD DR, SR1, imm5	LDI	<table border="1"><tr><td>1010</td><td>DR</td><td></td><td></td><td></td><td>PCoffset9</td></tr></table>	1010	DR				PCoffset9	LDI DR, PCoffset9
0001	DR	SR1	1		imm5												
1010	DR				PCoffset9												
	DR ← SR1 + SEXT(imm5), Setcc		DR ← M[M]PC + SEXT(PCoffset9)], Setcc														
AND	<table border="1"><tr><td>0101</td><td>DR</td><td>SR1</td><td>0</td><td>00</td><td>SR2</td></tr></table>	0101	DR	SR1	0	00	SR2	AND DR, SR1, SR2	LDR	<table border="1"><tr><td>0110</td><td>DR</td><td>Baser</td><td></td><td></td><td>offset6</td></tr></table>	0110	DR	Baser			offset6	LDR DR, Baser, offset6
0101	DR	SR1	0	00	SR2												
0110	DR	Baser			offset6												
	DR ← SR1 AND SR2, Setcc		DR ← M[Baser + SEXT(offset6)], Setcc														
AND	<table border="1"><tr><td>0101</td><td>DR</td><td>SR1</td><td>1</td><td></td><td>imm5</td></tr></table>	0101	DR	SR1	1		imm5	AND DR, SR1, imm5	LEA	<table border="1"><tr><td>1110</td><td>DR</td><td></td><td></td><td></td><td>PCoffset9</td></tr></table>	1110	DR				PCoffset9	LEA DR, PCoffset9
0101	DR	SR1	1		imm5												
1110	DR				PCoffset9												
	DR ← SR1 AND SEXT(imm5), Setcc		DR ← PC + SEXT(PCoffset9), Setcc														
BR	<table border="1"><tr><td>0000</td><td>n</td><td>z</td><td>p</td><td></td><td>PCoffset9</td></tr></table>	0000	n	z	p		PCoffset9	BR{nzp} PCoffset9	NOT	<table border="1"><tr><td>1001</td><td>DR</td><td>SR</td><td></td><td></td><td>1111111</td></tr></table>	1001	DR	SR			1111111	NOT DR, SR
0000	n	z	p		PCoffset9												
1001	DR	SR			1111111												
	((n AND N) OR (z AND Z) OR (p AND P)): PC ← PC + SEXT(PCoffset9)		DR ← NOT SR, Setcc														
JMP	<table border="1"><tr><td>1100</td><td>000</td><td>Baser</td><td></td><td></td><td>000000</td></tr></table>	1100	000	Baser			000000	JMP Baser	ST	<table border="1"><tr><td>0011</td><td>SR</td><td></td><td></td><td></td><td>PCoffset9</td></tr></table>	0011	SR				PCoffset9	ST SR, PCoffset9
1100	000	Baser			000000												
0011	SR				PCoffset9												
	PC ← Baser		M[PC + SEXT(PCoffset9)] ← SR														
JSR	<table border="1"><tr><td>0100</td><td>1</td><td></td><td></td><td></td><td>PCoffset11</td></tr></table>	0100	1				PCoffset11	JSR PCoffset11	STI	<table border="1"><tr><td>1011</td><td>SR</td><td></td><td></td><td></td><td>PCoffset9</td></tr></table>	1011	SR				PCoffset9	STI SR, PCoffset9
0100	1				PCoffset11												
1011	SR				PCoffset9												
	R7 ← PC, PC ← PC + SEXT(PCoffset11)		M[M]PC + SEXT(PCoffset9)] ← SR														
TRAP	<table border="1"><tr><td>1111</td><td>0000</td><td></td><td></td><td></td><td>trapvect8</td></tr></table>	1111	0000				trapvect8	TRAP trapvect8	STR	<table border="1"><tr><td>0111</td><td>SR</td><td>Baser</td><td></td><td></td><td>offset6</td></tr></table>	0111	SR	Baser			offset6	STR SR, Baser, offset6
1111	0000				trapvect8												
0111	SR	Baser			offset6												
	R7 ← PC, PC ← M[ZEXT(trapvect8)]		M[Baser + SEXT(offset6)] ← SR														