15F CST8216 Processor
Architecture Term Test
Tuesday, November 17, 2015

Solution F

Instructions

- . Place your name and student number in the space provided.
- Ensure that your copy of the test contains a total of 5 pages, including this cover page.
- There are a total of 40 marks available.
- Marks for each of the questions vary, and where noted you must show all of your work to be considered for full marks. Clearly indicate your answer to the questions.

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- A handout of the HCS12/9S12 Instruction Set Reference and other supplemental information is also provided with this test.
- This is a closed book test.
- No Scrap paper is permitted to be used during this term test use the back of any page if you need extra space to solve problems.
- 8. You may take this test apart if you wish; I have a stapler at the front of the class.
- 9. If you have any questions, raise your hand.
- 10. Calculators are permitted to be used in this test
- 11. Time limit: 50 minutes.

The use of electronic devices, with the sound turned on, during classes is strictly prohibited. In particular, cell phones are not to be used to communicate during a class. The use of any electronic devices during exams and mid-term tests, other than those sanctioned by the faculty in charge of the examination, is strictly prohibited.

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Anyone caught using a prohibited device will be considered to have plagiarized, and will be treated as such in accordance with College Plagiarism Policy.

This test is worth 10% of your overall course mark.

Circle Your Lab Day/Time Tue 10 - 12 Wed 1 - 3 Wed 3 - 5 Fri 2 - 4	Student Number	Name	
Tue 10 – 12			
Wed 1 - 3			
Wed 3 - 5			
Fri 2 – 4			

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Version A

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Number Conversions - (5 marks) Perform the following number conversions, placing your answers in the Value column:

Convert	To	Value
\$F9 (unsigned)	Integer '	249
\$F9 (signed)	Integer	17
\$3FFF (unsigned)	Integer	16383
72	8-bit Hexadecimal (unsigned)	8 4 \$
-72	8-bit Hexadecimal (signed – use 2's complement)	\$ 13%
-6	8-bit Hexadecimal (signed – use 2's complement)	OF RA
128	Binary	7,1000 0000
-128	Binary (use 2's complement)	2 1000 2000
11111111 (signed)	Integer	1
11111111 (unsigned)	Integer	77.55

BCD Arithmetic Methods – (5 marks) To confirm your understanding of BCD Arithmetic methods, represent 135,0 and 265,0 in BCD and then correctly perform BCD addition. Show all steps (including all annotations to the right of the additions) for full credit.

		+ 20 W
+ 0000	1 0000	00010
00000	1.01.0	-000 -001 -001
0000	0000	1000
CAUSED NAMED 60	CARRY OUT	CBCD SK 135 CBCD Sr 265 Howald BCD

Program Tracing (10 marks)

Given the following program listing, trace the results (hexadecimal value of registers being asked) of each program step **after** the line of code has been executed, as per the example answer for SP. (Instruction Set included with this Term Test).

	David Haley Faculty 7 Nov 2015 Fo manually trace through give \$1234 \$21 \$21 \$21 \$21 \$22000 \$3100011, \$54, \$82, 64 \$11100011, \$54, \$82, 64 \$22000 \$31000 \$31000 \$31000 \$31000 \$32	97 Idaa 98 Idaab 98 exg 40 Idy 41 Idy 42 end	36 Idab 37 Idx 38 Idx	22 23 24 25 26 30 27 27 27 28 28 29 11daa	16 org 18 org 19 1ds	8 9 VALUE1 equ 10 VALUE2 equ 11 org 12 org 13 Source db 14 Source2 dw	1; fracel_VA.asm 2; Name 4; S/N 5; Date 6; Date 7; Purpose
Haley ty 2015 0011, \$54, \$82, 64 0011, \$54, \$82, 64 : All Values must be i sample for Ids : Example for Ids : Asample for Ids : A = \$2000 et 3 : A = \$40 i B = \$34 i B = \$43 i B = \$40 et 3 : X = \$1004 ce2 : X = \$1004 ce4 : Y = \$5678	Haley ty 2015 2015 10011, \$54, \$82, 64 10011, \$54, \$82, 64 10011, \$54, \$82, 64 2	₩	o	p		w a a	
# through given Assemble for Ids All Values must be in the second of	through given Assembly Language All Values must be in Hexadecia Example for Ids See \$2000 A = \$12 A = \$440 A = \$5678 X = \$5678 X = \$5678					0011, \$54,	Haley ty 2015
\$2000 ss must be 1 st 5678 \$5678	given Assembly Language Sor Lts \$2000 \$12 \$12 \$440 \$402 \$5678 \$5678	# # #	* * * *	the too too too			e chrough
	n Hexadecin	45678	\$5678	4340	De De		liven Assemb

Programming Concepts - Analysis of Code (10 marks)

Given the following source code listing, indicate the LEDs' output pattern for two complete iterations of the for (;;) [forever] loop by completing the table that follows the code listing. Note that this is fully functional code, which correctly assembles and outputs a specific pattern on Fort B's LEDs.

To indicate that a specific LED is ON, Place an X in the appropriate box in the table as per the following example (which you should note is NOT part of the pattern produced by the code listing). If a specific LED is OFF, leave the appropriate box in the table blank.

Packer Mark Structed Wighort Marson Asm Finched C Continuation C
Expanded view of LEDTABLE \$00, \$18, \$24, \$42, \$81

《清秀电》

2250	2000	1750	1500	1250	1000	750	500	250	0	Time (msec)
X					X					PB7
	X					X				PB6
		X					X			P85
			X					X		P84
			X					×		PB3
		X					X			PB2
	X					×				PB1
X					×					PBO

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Version A

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Program Tracing (10 marks)

Given the following program listing, trace the results (hexadecimal value of registers being asked) of each program step **after** the line of code has been executed, as per the example answer for SP. (Instruction Set included with this Term Test).

-A	48 end	39 SW1	88	37	8	38 8		SS X	31 inx	36	26 29 ldaa	27 1dx	B.	S 5	28 Idab	N	21		19 ldaa	17 1dv		1 de	60	ES .	Data2	Datai	7 ; Purpose	s . Date	4 / S/N	S ; Name	1 ; Trace2_VA.asm 2
				; X = 2	477	00 H	4	5,x+	Agency con-		N. N	*Data2 ; X = 2 3 00 7		, Y = 3 (A)	1,4+ ;8=2 00 1		; Y = 2	,	0,y ; A = ? () 3 \)	*Darai : Y = ? Glob	J. W. V. Common	#\$2000 · sp = 2 \$2000	evample for los	事品は は他の 8年 17年間17日後の後の後の 27、 27、 27、 27、 27、 27、 27、 27、 27、 27、	SDA, \$33,	\$32, \$14, \$98, \$9D	To manually trace through given Assembly Language code	8 Nov 2015	Macelty	David Haley	SZZ

15F CST8216 Processor Architecture Term Test Tuesday, November 17, 2015



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Place your name and student number in the space provided.

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Student Number					
Circle Your Lab Day/Time Tue 10 - 12 Wed 1 - 3 Wed 3 - 5 Fri 2 - 4	Tue 10 – 12	Wed 1 - 3	Wed 3 - 5	Fri 2 – 4	

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Version A

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Version B

Number Conversions - (5 marks) Perform the following number conversions, placing your answers in the Value column:

10000

Convert	To	Value
\$F8 (unsigned)	Integer	248
\$F8 (signed)	Integer	N Q
\$1FFF (unsigned)	Integer	<u>00</u>
92	8-bit Hexadecimal (unsigned)	جه ان (۲
-92	8-bit Hexadecimal (signed – use 2's complement)	3 A.L
-6	8-bit Hexadecimal (signed – use 2's complement)	S F D
128	Binary	2 10000000
-128	Binary (use 2's complement)	% 0000000
111111110 (signed)	Integer	70
11111110 (unsigned)	Integer	254

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BCD Arithmetic Methods – (5 marks) To confirm your understanding of BCD Arithmetic methods, represent 265₁₀ and 135₁₀ in BCD and then correctly perform BCD addition. Show all steps (including all annotations to the right of the additions) for full credit.

44.987868

1 127790397		
	Total Control	26510 1 2510
0000	+0000	6510 +0001 0011 0101 4 80 88 3510 +0001 0001 0001
0 0	0000	0010
00000		000
CARRY ON T CANSED IN MAID BCD . ADD 60	ADD 6	0101 282 82 735
	0000 0000	1000 010 6

Program Tracing (10 marks)

Given the following program listing, trace the results (hexadecimal value of registers being asked) of each program step **after** the line of code has been executed, as per the example answer for SP. (Instruction Set included with this Term Test).

```
1; Trace1_VB.asm
2; Name
1; 5/N
5; Date
                                                                                                                                                            9 VALUEZ equ
                                                                                                                                                                      6 ; Purpose
7
                       ldaa
ldab
exg
                                                             ldab
                                                                      ldaa
                                                                                                                                                                                    David Haley
Faculty
7 Nov 2015
                                                                                                                                                             $5678
$21
                        #$02
#$01
                                                             $1000
                                                                                                                    $2000
$$2000
                                                                                                                                           $1000
%00111100, $82, $54, 128
$1234
               Source+4
                                          #Source2
                                                    Source?
                                                                     Source+3
                                                                                                           $Value1
                                                                                                                                                                           To manually trace through given Assembly Language code
                                                    ×
                                                                                                          is
See
                                                                                                                    . 5
                        ),
(5)
(1)
                                                             tu
tu
                                                                     to
B
                                                                               tu
tu
                                                                                        to
But
                                                                                                 5 x
03
8
                                                                                                                             All Values must be in Hexadecimal as per the example for ids
                                                                                                                   $2000
                                                                                                           $ 56
                                                                                                  $ 78
                        $0
                                                    $1234
                                                                                 518
                6
                                            09
              1234
                                            1004
                                                                      80
```

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Version B

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Version B

Programming Concepts - Analysis of Code (10 marks)

Given the following source code listing, indicate the LEDs' output pattern for two complete iterations of the for (;;) [forever] loop by completing the table that follows the code listing. Note that this is fully functional code, which correctly assembles and outputs a specific pattern on Port B's LEDs.

To indicate that a specific LED is QN, place an X in the appropriate box in the table as per the following example (which you should note is NOT part of the pattern produced by the code listing). If a specific LED is QN, place an X in the pattern produced by the code listing).

#Enclude C:V	Time (mase) P87 3000 #################################	Version.asm	P86	8 3	P83	× 28.2	980
; Program Constants	instants						
SIAUX equ	00074						
; Delay_MS Constants DVALUE eqn #250		; Delay value (base 10) 0 - 255 ms	10) 0 - 255	51 19			
org	\$1000 ; dat	data area					
LEDIABLE	; val	values to display on LEDs	on LEDs				
8	SB1, \$42, \$24, \$18, \$00	, 818, 800					
ENDIABLE							
org	\$2000 ; pro	; program code					Exnan
Start 1ds	24	; stack location -					Expanded view of
jsr	Config_SWs_and_LEDs	d_LEDs					Expanded view LEDTABLE
continually	; Continually Flash LEDs with values from LEDTABLE, changing values every 250 ms	values from La					Expanded view of LEDTABLE \$81, \$42, \$24, \$18, \$00
(11) TOT (11)		i	DTABLE, cha	ging values e	every 250 ms	\	Expan LEI \$81, \$42
Back ldx	#LEDTABLE	; point to f	DIABLE, cha	ging values e	every 250 ms	<u></u>	Expan LEI \$81, \$42
Again ldaa	1,x+		DIABLE, cha	ocation De from LEDTABLE, changing values e point to first element of LEDTABLE	every 250 ms	\	Expan LEI \$81, \$42
staa		; get first	DTABLE, cha	Destion Ne from LEDTABLE, changing values e mos from LEDTABLE, changing values e point to first element of LEDTABLE get first value, increment pointer	every 250 ms		Expan LEI 881, \$42
		; get first value, inc ; output value to LEDs ; dalway value	DTABLE, char irst elemen value, incr me bo LEDs	ging values e of LEDSABLE ment pointer	every 250 ms		Expanded view LEDTABLE \$81, \$42, \$24, \$18
opx.	STRUCTURE - NO.	; get first v ; output value ; delay value	DTABLE, cha	ging values e	svery 250 ns		Expan LEI 381, \$42
bne	Again	; get first value ; output value ; delay value ; delay routine ; one less to do	TRABLE, char Erst elemen velue, incr ve bo LEDs e ine o do	ging values e	des every 250 ms		Expan LEI \$81, \$42
bra		get first couppit val coeley val coeley rout coeley rout coeless coele	PTABLE, char Erst elemen velue, incr we be LEDs e ine	ging values e	every 250 ms	87	Expan LEI 381, \$42
; Predefined *include C:\	Sack	get first value delay value delay routin delay routin delay foutin	DTRBLE, che	of LEFFABLE ment pointer	every 250 ms	\$81;	Expan LEI 381, \$42.
	bra Back , endless loop ; Predefined Subroutines Follov #include C:\668C512\IIB\Config_SWs_and_IEDs.asm	g_SWm_and_IEDm.	DTABLE, chai	ging values e of Labranta ment pointer	overy 250 ms	87	Expan LEI ,881, \$42
#include C:\\ end	bra Back , en , Predefined Subroutines Follov %include C.\68MCSI2\LIB\Contig SNs a %include C.\68MCSI2\LIB\Delay_ms.am end	; get first ; output val ; delay val ; delay rou ; delay rou ; delay rou ; one less; ; done yet; ; don	DTABLE, chai	ging values e	Svery 250 ns	87	Expan LEI 581, \$42

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Indicate the LEDs' output pattern by completing this table (1 mark per correct line):

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2250	2000	1750	1500	1250	1000	750	500	250	0	Time (msec)
				×					X	PB7
			Х					X		P86
		Х					X			P85
	X					X				P84
	Х					X				PB3
		X					X			PB2
			Х					X		PB1
				X					×	PBO
-		-		010	GA 8	. (A.	CA	447	60	

- 人名普雷格尔

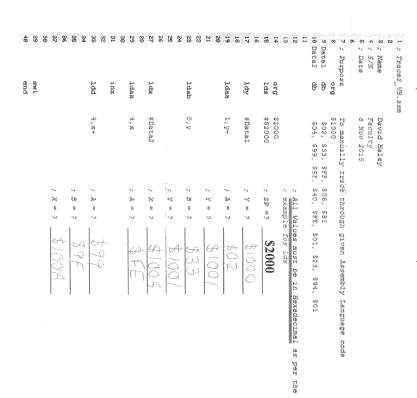
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Version B

Program Tracing (10 marks)

Given the following program listing, trace the results (hexadecimal value of registers being asked) of each program step **after** the line of code has been executed, as per the example answer for SP. (Instruction Set included with this Term Test).



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Version B