Midsem Solutions CSE/ECE 511 Computer Architecture

Q1 Marks distribution:

Instruction No.	Marks
1	No marks
2	0.5
3	0.5
4	0.5
5	0.5
6	1
7	1
8	1
9	1
10	1
11	No marks

0.5 Mark for cycle count

a.

	0	1	2	3	4	5	6	7	80	1	10	11	12	13	14	15	16	17	10	19/20
MOV RIY RIS	F	D	X	M	W					1									10	17/20
10 R4 0(R3)		F	D	X	M	W					1.			10	13	100				
LD R2 4(R4)			F	D	D	D	D	X	M	W									70	
LWI RIO #0				F	F	F	F	D	X	M	W	M							1	
BEQ R14 R15 11				1				F	D	X	M	W	(8)	1	100	103				
ADD RT R8 R9		110	10						F	D	-	1	1-				1			
SUB BA R3 RG									19	F	-	1	1	200						
L1: BNEZ RIO, L2										A	F	D	X	M	W					
ADD RII RIZ RIB												F	D	X	M	W				
ADD RII RI BIS													F	D	×	M	W			
12: ADD RI RII R3														F	D	D	D	D	X	MV
MODELLE REPORT			-	1					1		-	1		1		1	1			
Was and Ma				10	ta	l ı	NO	. 0	L .	we	les	=	2	2.1						
		4							V	0			~							111

	0	ı	2	3	4	5	16	1 7	18	19	11	01	11	12	131	141	151
MOV RIY RIS	F	D	X	M	W												
LD RY ORS)		F	D	X	M	W											
LD RZ Y(RY)		1	F	D	D	X	M	W									
LWT RIO HO	-	-		F	F	D	X	M	W								
BEB RIY RIS LI				1		F	D	X	М	W							
ADD R7 R8 R9		-	-	-	-		F	D	-	-	-						
SUB BT R3 R6	-			-	-	1	1	F	-	-	-	-					
11. BNEZ RIO, 62		1	-	-	-	1	-	-	F	D	X	M	W		1		
ADD RII RIZ BI3			-	-		-	-			F	D	X	M	W			
ADD RII RI BIS		1	1	1	1	-					F	D	X	M	W		
12: ADD BI RIK	3			1	-							F	D	X	M	1	N
	1	1	1	1	1		1				1	1				1	1
	10	oto	rl v	10.	0	k	cy	elis	-	: 1	6						
	. 10	010	W V	w.	0	5	cy	us			0						

Q2

- a. 10,000 * 32 /8 = 40,000 bytes 2 Marks
- b. 3:1 for L : S type instruction therefore 7500 instruction of L and remaining 2500 instruction of S. Therefore 7500 * 4bytes + 2500 * 2bytes = 30,000 + 5,000 = 35,000bytes. These 7500 instructions will be stored in ImemA and the rest 2500 instructions will be stored in ImemB. 2 Marks
- c. 10,000 instructions and 4 bytes for the address of each instruction therefore 40,000bytes for sending address.

40,000 * 1 (for sending address) + 40,000 * 1 (sending instruction data back) nJ = 80,000nJ. - 2 Marks

- d. 40,000 nJ for sending address since for both instruction memory, address space is 32-bit. 7500*4*1 =30,000nJ for sending instruction data back for type L instructions from ImemA. 2500*2*3=15,000nJ for sending instruction data back for type S instructions from ImemB. Therefore total is:
 - 40,000 (for sending address) + 45,000 (sending instruction data back) nJ = 85,000nJ.

- 2 Marks

- e. Total bytes transferred = 80,000. Therefore, we need 80,000ms 2 Marks
- f. Total bytes transferred = 75,000. Therefore, we need 75,000ms 2 Marks

g. In FL-ISA there are no 16-bit instructions hence no memory is required in Imem B.

ISA	Imem A	Imem B
FL-ISA	40,000 Bytes (0.5 Mark)	0 Bytes (0.5 Mark)
VL-ISA	7500 * 4 = 30,000 Bytes (0.5 Mark)	2500 * 2 = 5000 Bytes (0.5 Mark)

 VL-ISA takes less time hence will be preferred for server-type processors whereas
 FL-ISA takes less energy and hence will be preferred for mobile-based processors. - 1
 Mark

Diver Naffer cycletine = 0.4 hs miss-sate = 6.8%. hiso penelty = 100 ns hit time = layde AMAT = hit time + MRX MP = 1×0.4 + 6.8 × 100 = 0.4 + 6.8 = 7.2 mg 2-way set -associative Cycle time = 1.4 ns MR = 4.91. AMAT = MT + MRXMP = 1.4 + 4.9 ×100 = 9.9+1.9 4-way MR= 4.4 1. cycletime = 1.4 hs AMAT = NT+ MRXMP $= 1.4 + 4.4 \times 100 = 4.4 + 1.4$ $= 1.4 + 4.4 \times 100 = 5.8 \text{ m}$ As associativity increases the AMAT decreases

[Address 100 and add 106 data loaded in cache, [0.5 for each miss, hit, compul, or capacity => 4.5marks]
[1 mark for each dirty_bit=1 mark,=> 3 marks]
[LRU correctly used, 2 marks]
[0.5 marks for each correct register value=> 3 marks]

LDR	3, [100]	[001]			miss	Compil) ,				
CD B	1, 106	7	RI	= 21	miss	,					
HDD 6	24 R3	OIRI	RU	276							
31	RY [ws	5-)			Hi-	_					
SOB	RST R2	RI	RS	=82	_						
ST	R5- [10	37			Hit	_					
LD	R2, [10	้นไ	R2	269	Miss	capacity					
	R7, RI		RA	+= 90	_						
ST	R7,[1	TYO		37.7	pit	_					
_	Aind Cac	he sto	te.								
Add.	Data.	Disty	Bit	08	Add.	Data	Dirty Rit				
103	82	1			103	89	1				
105	76	1			105-	76	1				
104	90	1			102	18	0				
101	7	0			104		1				
100	22	0			100	55	0				
106	21	0			106	21	0				