Assignment Project Exam Help

Add WeChat powcoder

L3_1 ISAs — Instructions and Assignment Project Exam Help Memory https://powcoder.com

EECS 370 – Introduction to Computer Organization – Fall 2020

Assignment Project Exam Help Learning Objectives Add WeChat powcoder

- Identify the addressing modes of memory operations used in assembly-language instructions and programs
- Understand encoding in the single for Fassem by language instructions for load, store, and branching instructions
- Usage and encoding of labels for assembly-language programs Add WeChat powcoder

Assignment Project Exam Help Resources Add WeChat powcoder

- Many resources on 370 website
 - https://www.eecs.umich.edu/courses/eecs370/eecs370.f20/resources/
 - ARMv8 referencesignment Project Exam Help
 - Binary, Hex, and 2's compliment
- Discussion recordings

https://powcoder.com

Piazza

Add WeChat powcoder

Office hours

Assignment Project Exam Help What is a Bit? Add WeChat powcoder

- Bit: Smallest unit of data storage
 - Values [0, 1]
 - Many things will be measured (for size) in bits.

 Schoment Project Exam Help
 - 32-bit register a register with 32 binary-digits of storage capacity

 - 32-bit address memory addresses with 32 binary digits
 - 32-bit operating system Acdrophie With 22-bit who dest
- Byte: A collection of 8 bits (contiguous)
 - On many computers, the granularity for addresses
- Word: natural group of access in a computer
 - Usually 32 bits
 - Useful because most data exceeds 1 byte of storage need

Assignment Project Exam Help Assembly and Machine Code Add WeChat powcoder



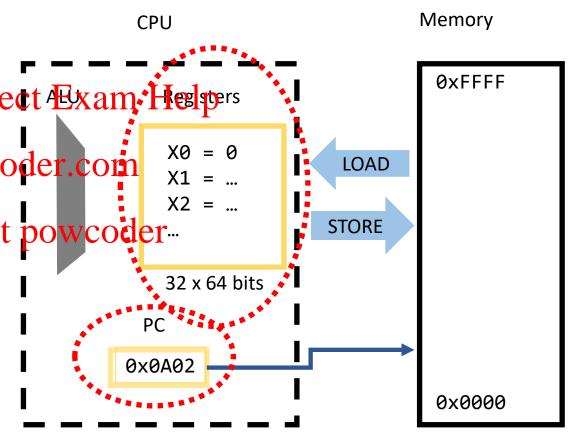
- von Neumann architecture: computers store data and instructions in the same memory
- Instructions are data, simented assignifican Help

	https://powdopcode	coder.com dest	src1	src2
Assembly code	Add Ween ADD	X2	Х3	X1
Machine code	011011	010	011	001

Assignment Project Exam Help Registers Add WeChat powcoder



- Registers
 - Small array of storage locations in the processor – general purpose
 Assignment Project Exam Helpers registers
 - Part of the processor fast to access https://powcoder.com
 - Direct addressing only
 - That means they can Act be We Chat bowcoder... accessed by an offset from another address
 - Special purpose registers
 - Examples: program counter (PC), instruction register (IR)



Assignment Project Exam Help Registers Add WeChat powcoder

ARMv8

- We will use LEGv8 from Patterson & Hennessy textbook
- 32 registers, Xo Project Exam Help
- 64-bit wide (64 bits of storage for each register)
- Some have special uses, e.g., X31 always contains the value 0 Add WeChat powcoder
- LC-2K
 - Architecture used in course projects
 - 8 registers, 32 bits wide each

LC2K is same as LC-2K Appears both ways in documents in 370

Assignment Project Exam Help Special Purpose Registers Add WeChat poweder

- Return address
 - Example: ARM register X30, also known as Link Register (LR)
 - Holds the return address on link address of a subjustine
- Stack pointer

 - Holds the memory address of the stack Add WeChat powcoder
- Frame pointer
 - Example: ARM register X29 FP
 - Holds the memory address of the start of the stack frame
- Program counter (usually referred to as PC)
 - Cannot be accessed directly in most architectures
 - This would be a security problem!

These registers store memory addresses

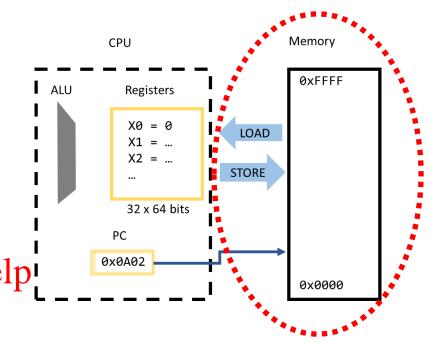
Assignment Project Exam Help Special Purpose Registers Add Wechat poweder

- Ø value register (ARM register X31 XZR)
 - no storage, reading always returns 0
 - lots of uses ex: Assygnadeht Project Exam Help
- Status register
 - Examples: ARM SPSR, or x86 EFLAGS
 - Status bits set by various instruction sowcoder
 - Compare, add (overflow and carry) etc.
 - Used by other instructions like conditional branches

Assignment Project Exam Help Memory Storage Add WeChat powcoder

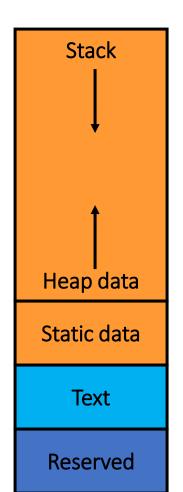
- Large array of storage accessed using memory addresses
- A machine with a 32-bitigoldness darojeter Excen Helpt memory locations 0 to 2³²-1 (or 4,294,967,295). https://powcoder.com
- A machine with a 64-bit address can reference der memory locations 0 to 2⁶⁴-1 (or 18,446,744,073,709,551,615—18 exa-locations)
 - In practice 64-bit machines do not have 64-bit physical addresses

Assembly instructions have multiple ways to access memory (i.e., addressing)



Assignment Project Exam Help Memory: ARM (Linux) Memory Image Add WeChat powcoder





Activation records: local variables, parameters, etc.

Assignment Project Exam Help

https://powcoder.com

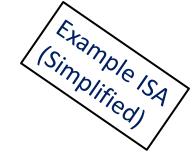
Dynamically allocated data—new or malloc()

Global data and static local data

Machine code instructions (and some constants)

Reserved for operating system

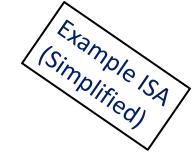
- Addressing (accessing memory using addresses) modes for assembly instructions
 - Direct addressing Assignonyeadd Pessies in Ebeains Urlection
 - Register indirect memory address is stored in a register
 - Base + displacement register indirect plus an immediate value
 - PC-relative base + displacement using the PC special-purpose register



Specify the address as immediate (constant) in the instruction

```
load r1, M[ 1500Alsignment Procenters of the pocation 1500 jump #6000 ; jump to address 6000 https://powcoder.com
```

Add WeChat powcoder



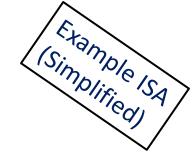
Specify the address as immediate (constant) in the instruction

```
load r1, M[ 1500Assignment Procenters of fellocation 1500 jump #6000 ; jump to address 6000 https://powcoder.com
```

Not practical for something Wecker

```
load r1, M[1073741823] // 1073741823 is the address in memory With 32-bit instruction encodings, a 32-bit address would fill the instruction!
```

Assignment Project Exam Help Register Indirect Add WeChat powcoder



Store reference address in a register

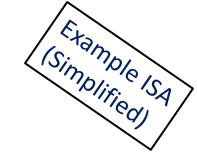
Assignment Project Exam Help memory

load r1, M[r2]
add r2, r2, #4
load r1, M[r2]
Add We

register file
https://powcoder.com
R1 6666
Add WeChatRp 3840der

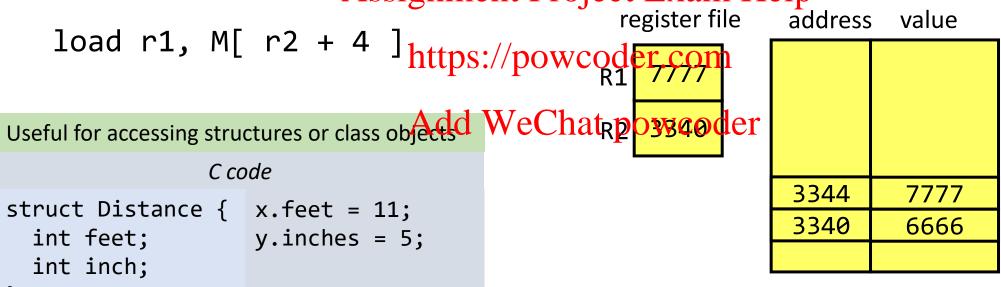
Useful for pointers and arrays load r1, M[r2] is a pointer dereference in assembly

Assignment Project Exam Help Base + Displacement Add WeChat powcoder



- Most common addressing mode
- Address is computed as register value + immediate

 Assignment Project Exam Help memory register file address value

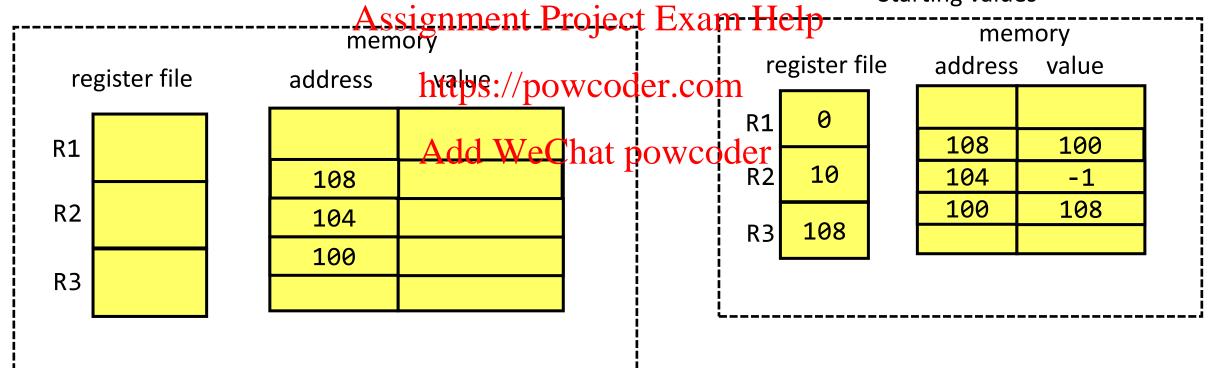


} x, y;

What are the contents of registers and memory after executing the assembly instructions?

load r2, M[r3]
load r3, M[r2 + 4]
store r3, M[r2 + 8]

Starting values



What are the contents of registers and memory after executing the assembly instructions?

				<	(Simple ISA)
√1oad	r2,	M[r3]	(0)
⊅ load	r3,	Μ[r2	+	4]
≯ store	r3,	M[r2	+	8]108

Starting values Assignment Project Exam Help memory memory register file address value https://powcoder.com register file address 0 **R1** Add WeChat powcoder **R1** 108 100 10 104 -1 108 100 108 R2 104 108 R3 100 R3

What are the contents of registers and memory after executing the assembly instructions?

load r2, M[r3]
load r3, M[r2 + 4]
store r3, M[r2 + 8]

	load r2, M[r3] Assignment Project						Starting values					
[Lojeci	Exai		men	nemory						
re	gister file	address	https://po	wcod	er.coi	n m	egister fil	e	address	value	1	
					į	R1	0		100	100		
R1	0		Add WeC	hat p	owco	der	10		108	100		
! ! !		108	100		i	R2	10		104	-1	4	
R2	100	104	-1		i	R3	108		100	108	4	
		100	108		i	ן 	100					
R3	108											
į					ţ	L						

What are the contents of registers and memory after executing the assembly instructions?

load r2, M[r3]
load r3, M[r2 + 4]
store r3, M[r2 + 8]

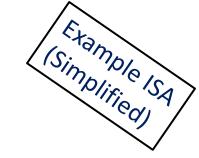
	load	r3, M[r2 + 4]	roject I	Zvom	Holp	tarting value	! S	
re	gister file	mer address	signment Proof		ļ	register file		nory value	 1
R1	0	108	Add WeC	hat po	wcode	R1 0 er R2 10	108 104	100 -1	
R2	100	104	-1			R3 108	100	108	-
R3	-1	100	108				<u> </u>		
•									

What are the contents of registers and memory after executing the assembly instructions?

load r2, M[r3]
load r3, M[r2 + 4]
store r3, M[r2 + 8]

	sto	ore	r3, M[r2 + 8]		4 E 0	TT	-1	Stai	rting value	S	
			mem	signment P	rojec	l Exal	! !	•		men	•	
reg	gister file		address	https://po	wcod	ler.co	re M	egister fil	e	address	value	7
[_					1		0		100	100	
R1	0		108	Add WeC	lhat p	OWCC	der R2	10		108	100 -1	
R2	100		104	-1						100	108	
ŀ			100	108			R3	108				
R3	-1											
L						•						

Assignment Project Exam Help Program Counter (PC) Relative Add WeChat powcoder



Useful for project - P1a

Variation of base + displacement

• PC register is the base

Assignment Project Exame Pholipive or negative

https://powcoder.cojump

Relative distance from PC can

Useful for branch instructions!

Add WeChat powcoder



- Machine language instructions (encoded from an assembler) use numbers for pc-relative addressing'
- Assembly language instructions (wintle happy be by use labels

https://powcoder.com

Add WeChat powcoder



- Machine language instructions (encoded from an assembler) use numbers for pc-relative addressing'
- Assembly language instructions (winter by people) use labels

```
Address
                             https://powcoder.comolic address)
                lw 0 1 five
                lw 1 2 3
                              load reg2 with -1 (numeric address)
                              ActdeWeChet1powcoder
     2
               add 1 2 1
         start
                              goto end of program when reg1==0
               beq 0 1 2
                beq 0 0 start
                              go back to the beginning of the loop
                noop
               halt
         done
                              end of program
         five .fill 5
         neg1 .fill -1
         stAddr .fill start
      9
                              will contain the address of start (2)
```



beg 005+an+

```
CommenT5
Address
                             oad reg2 with -1 (numeric address)
                            decrement reg1
        start
               add 1 2
                            TOWER COULT When reg1==0
                    0 start
                            go back to the beginning of the loop
                            WeChat powcoder
               noop
                             end of program
               halt
        done
               .fill 5
        five
               .fill −1
        neg1
        stAddr .fill start
                             will contain the address of start (2)
```

Assignment Project Exam Help Project P1a WeChat powcoder

• After reading specification, downloading starter files, creating project...

• Write test cases to verify your C code

Assignment Project Exam Help

- Test cases written in LChatkpesseproblycoder.com
- Recommended for a start: WeChat powcoder

```
t0.ac: halt t3.ac: nor 3 1 4
```

t1.ac: noop halt

halt t2.ac: add 1 2 3

halt

Assignment Project Exam Help Logistics Add WeChat powcoder

- This is the first of 3 videos for lecture 3
 - L3 1 ISAs Instructions and Memory
 - L2_2 Two's Complexignment Project Exam Help
 - L2 3 LC-2K ISA

- https://powcoder.com
 There are two worksheets for lecture 3
 - 1. Addressing and 2's compter Men Chat powcoder
 - 2. LC-2K program encoding
- Move on to L3 2 when ready