

中国科学技术大学

2016-2017 学年第二学期考试试卷

考试科目：计算机组成原理

得分：

院系：

姓名：

学号：

一、简单题 (40 分=5 分*8)

现代计算机优化冯诺依曼结构


现代计算机以存储器为中心，而冯诺依曼结构以运算器为中心。

指令类型&寻址方式

P176-181

中断系统组成

0、中断机构组成



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1. CPU中断禁止/允许：IF@PSW

PSW即程序状态字（程序状态寄存器），Program Status Word。

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
				OF	DF	IF	TF	SF	ZF		AF		PF		CF

8086/8088


2. CPU中断请求/响应控制：INTR、INTA

3. 中断响应/返回：中断隐指令

4. 断点/现场保存：MEM (stack)

5. 中断服务

- ✓中断源识别/判优：中断控制器
- ✓ISR入口：向量方式、非向量方式



嵌入式系统实验室
EMBEDDED SYSTEM LABORATORY
Beihang University and Tsinghua University

一个请求源对应一个 INTR 中断请求标记触发器

①保护程序断点②寻找服务程序入口地址③关中断
通过中断控制器识别和判优中断源。

中断隐指令保护断点、中断服务程序 ISR 保存和恢复寄存器内容。

总线同步异步半同步的读写时序图

同步/异步传送例题

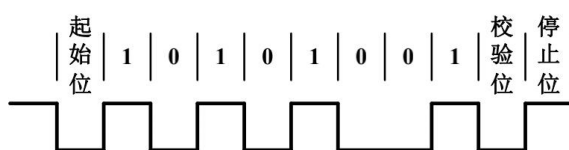


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- 例 画图说明异步串行传送方式发送十六进制数据95H。要求字符格式为：1位起始位、8位数据位、1位偶校验位、1位终止位

解：95H = 1001 0101B

异步串行传送在起始位后传输数据位的最低位，数据位的最高位之后传输校验位，最后终止位。95H的偶校验位为0，波形图如下：



?

快表慢表作用

快表:

✓为什么要使用快表?

- 页表一般保存在主存中，即使逻辑页已经在主存中，也至少需要访问两次物理主存才能完成需要的访存操作，这使得虚存的存取时间加倍

✓为减少访存次数，对页表进行二级缓存，将页表中最活跃的部分存放在高速存储器（如Cache）中，组成快表TLB

- TLB：专用于页表缓存的高速存储部件
- 保存在主存中的完整页表称为慢表

慢表:

?

示意图表示指令周期、机器周期、访存周期、总线周期、DMA 周期之间关系

定长机器周期：机器周期=时钟周期

不定长指令周期：分别为 3、4、5 个机器周期

总线周期指完成一次总线操作的时间

DMA 周期挪用 (周期窃取)

DMA 控制器与主存间传送一个数据时, 占用 (窃取) 一个或多个 CPU 周期。即 CPU 暂停工作一个周期, 然后继续执行程序。

CPU 设计步骤

指令集、单周期、多周期、流水线、数据通路、控制信号、状态机

PC, 手机区别

<https://www.jianshu.com/p/a227659401c4>

二、综合题 (60 分)

~~1. 用 4 位 booth 算法计算 3×4 (7 分)~~

2.cache 直接映射, 判断 hit/miss (8 分)

P132-136

3.disk/DMA controller,作用, 工作方式 (7 分)

查 PPT!

4.计算存储器单个芯片全部以及总容量, 位数 (8 分)

P110-111

5.abs instruction : why mips don't have?, if have, what format?

abs instruction: 绝对值指令

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25 This is how the C library function `abs()` does it in assembly without branching:

$$\text{abs}(x) = (x \text{ XOR } y) - y$$

where $y = x \gg 31$ (assuming 32-bit input), and \gg is arithmetic right shift operator.

Explanation of the above formula: We want to generate 2's complement of negative x only.

$y = 0xFFFF$, if x is negative
 $0x0000$, if x is positive

So when x is positive $x \text{ XOR } 0x0000$ is equal to x . And when x is negative $x \text{ XOR } 0xFFFF$ is equal to 1's complement of x . Now we just need to add 1 to get its 2's complement which is what expression $-y$ is doing. Because $0xFFFF$ is -1 in decimal.

Let's look at assembly generated for following code by gcc (4.6.3 on my machine):

C code:

```
main()
{
    int x;
    int output = abs(x);
}
```

gcc 4.6.3 generated assembly snippet (AT&T syntax), with my comments:

```
movl -8(%rbp), %eax    # -8(%rbp) is memory for x on stack
sarl $31, %eax         # shift arithmetic right: x >> 31, eax now represents y
movl %eax, %edx        #
xorl -8(%rbp), %edx    # %edx = x XOR y
movl %edx, -4(%rbp)    # -4(%rbp) is memory for output on stack
subl %eax, -4(%rbp)    # (x XOR y) - y
```

BONUS (from Hacker's Delight): If you have a fast multiply by +1 and -1, the following will give you `abs(x)`:

```
/(x*x+20) > 31 < 31
```

Related

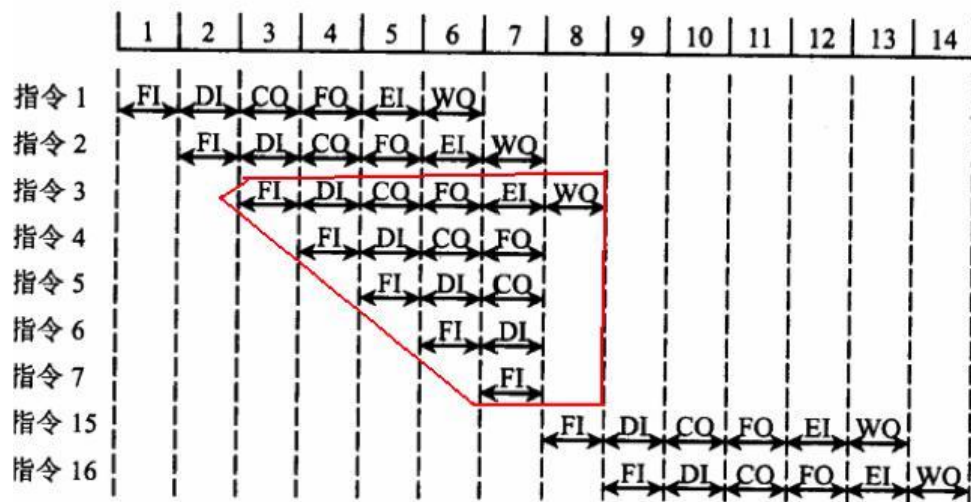
- 332 How can I determine if a .NET assembly was built for x86 or x64?
- 483 When is assembly faster than C?
- 247 What does multicore assembly language look like?
- 650 How do I achieve the theoretical maximum of 4 FLOPs per cycle?
- 1444 Replacing a 32-bit loop counter with 64-bit introduces crazy performance deviations with `_mm_popcnt_u64` on Intel CPUs
- 842 C++ code for testing the Collatz conjecture faster than hand-written assembly - why?

Hot Network Questions

- How do I print the last sequence of lines between a start and an end pattern?
- Avoid walking into a rectangle
- Encouraging a diverse pool of applicants for a postdoctoral position?
- Can a warlock with Repelling Blast use Eldritch Blast to push 10 feet a creature of any size?
- I feel like my DMing skills are making the game less enjoyable
- How to share solutions in a way they won't get uploaded
- How many different versions of cover art has Frank Herbert's Dune had since 1965?
- Why aren't garage door sensors retroflective on one end?
- Does tire pressure affect rolling resistance on pavement?
- How to draw alpha helices in Chemdraw?
- How do I engage someone who is playing his character poorly?
- Why is "TZ=Asia/Kolkata date --date='1/1/1906'" invalid?

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6.pipeline (10 分)



跳转指令是？

指令 3

延迟槽可插入几条指令？

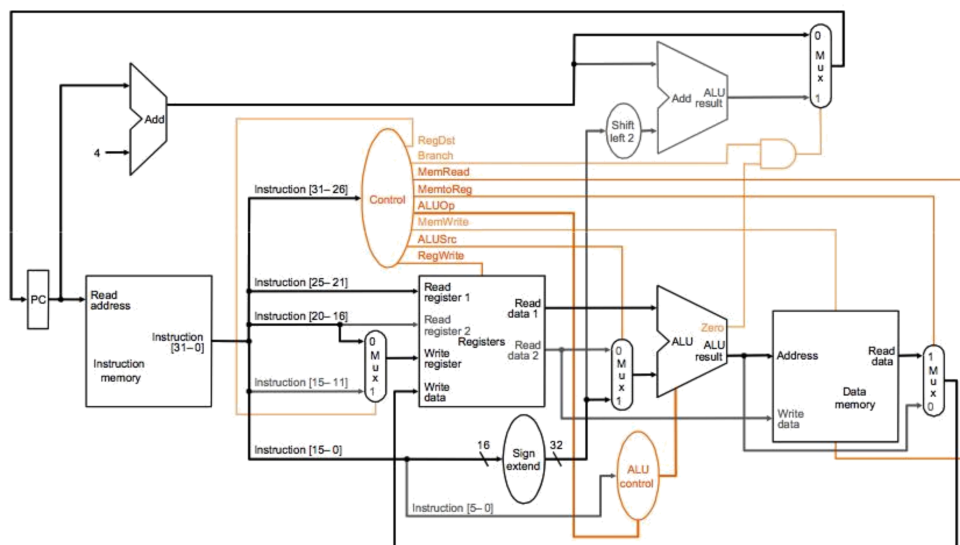
4 条 4~7

为减少流水线损失可采取哪些措施？

分支预测等。

可以试试 P250 第 5 题

7.指令执行 (15 分)



and sw 指令执行过程?

执行中的控制信号?

若采用单周期, 则指令周期长度是?