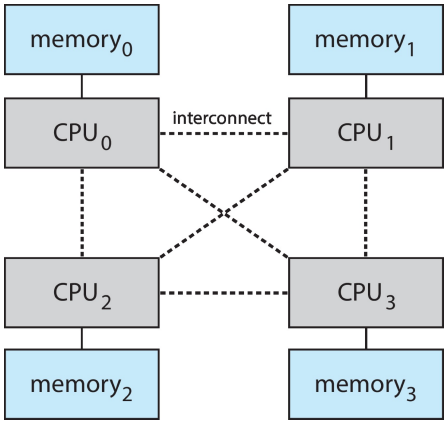
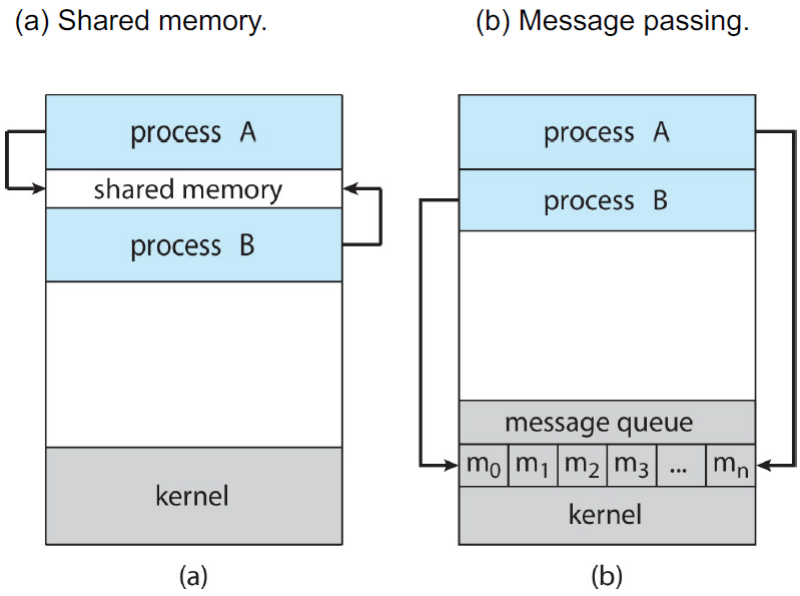
- 40选择 1.5一个 10分填空 30分大题
- DMA：不在CPU参与的情况下在设备之间搬运数据
- 注意措辞和RISCV的区别
  - Interrupts and Traps
  - 确定中断源：polling / vectored interrupt system
- SMP：共享物理memory，Symmetric Multiprocessing Architecture
- NUMA：Non-Uniform Memory Access



- 等待信号量：running状态到blocked状态
- 选择题比较多
- 进程间通信 IPC



  - 共享内存
  - 消息传递
- 同步肯定有一道大题
- 同步
  - Race condition
  - CS Critical Section

- monolithic

- batch / time sharing / real time
- B（主存会涉及到，因为需要读写PCB）

8. The context-switch causes overhead by OS. The action affects many objects, but __ is not included.

A. register　　B. global variable

C. stack　　D. memory

JJM习题

- 9. 若一个用户进程通过read系统调用读取一个磁盘文件中的数据，则下列关于此过程的叙述中，正确的是___。

  Ⅰ. 若该文件的数据不在内存，则该进程进入等待状态

  Ⅱ.请求read系统调用会导致CPU从用户态切换到核心态

  Ⅲ. read系统调用的参数应包含文件的名称

  open才需要文件的名称
  read和write需要: fd, buffer, count

  单选题 (8 分)　8分

  A. 仅Ⅰ、Ⅱ

- 2. While a process is blocked on a semaphore'squeue, it is engaged in busy waiting.

  判断题 (4 分)　4分

  A. TURE

  B. FALSE

- Solution to Critical-Section: Three Requirements
- working set
- When the process executes the wait () operation and finds that the semaphore value is not positive it must wait. Rather that engaging in busy waiting the process can block itself. The block operation places a process into a waiting queue associated with the semaphore and the state of the process is switched to the waiting state.

  The process that is blocked waiting on a semaphore S should be restarted when some other process executes a signal () operation, the process is restarted by a wakeup () operation.

  Definition of semaphore as a C struct

```
typedef struct {
    int value;
    struct process *list;
} semaphore;
```

Each semaphore has an integer value and a list of processes list. When a process must wait on a semaphore, it is added to the list of processes. A signal() operation remove one process from the list of waiting processes and awakens that process.

Wait () operation can be defined as

```
Wait (semaphore *s) {
    S->value--;
    If (s->value <0) {
        Add this process to S->list;
        block (); } }
```

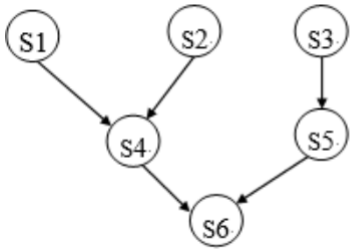
Signal operation can be defined as

```
Signal (semaphore *S) {
S->value++;
If (S-> value <=0) {
    Remove a process P from S-> list;
        Wakeup (P);  } }
```

The block () operation suspends the process that invokes it. The wakeup () operation resumes the execution of a blocked process P.

This is a critical section problem and in a single processor environment we can solve it by simply inhibiting interrupts during the time the wait () and signal () operations are executing and this works in single processor. Where as in multi processor environment interrupts must be disabled on every processor.

- Forthe following questions,consider a set of code sections (S1-S6) executing concurrently.



Here is the incomplete solution for solving this synchronization problem:

Semaphore a = *(1)*, b = *(2)*, c = 0, d = 0, e = 0;

Section S1: { …; *(3)*; }

Section S2: { …; *(4)*; }

Section S3: { …; *(5)*; }

Section S4: { wait(a); (6); …; *(7)*; }

Section S5: { wait(c); …; *(8)*; }

Section S6: { *wait(d)*; *wait(e)*; …; }

- 2. A computer system has a device with n mutually exclusiveinstances. Three concurrent processes require 3,4 and 5 instances. To ensuredeadlock not to occur, what is the minimum number n?

单选题 (10 分) 10分

分别拿了2 3 4个资源，从而卡住

- A. 9
- B. 10
- C. 11
- D. 12

- thrashing
  - the processor spends most of its time in swapping pages, rather than executing them

- Belady's Anomaly 异常
  - 采用FIFO算法时，如果对一个进程未分配它所要求的全部页面，有时就会出现分配的页面数增多但缺页率反而提高的异常现象
- 页替换的second chance
  - 指针指向的是下一个要被替换的page

The basic algorithm of second-chance replacement is a FIFO replacement algorithm. When a page has been selected, however, we inspect its reference bit. If the value is 0, we proceed to replace this page; but if the reference bit is set to 1, we give the page a second chance and move on to select the next FIFO page. When a page gets a second chance, its reference bit is cleared, and its arrival time is reset to the current time. Thus, a page that is given a second chance will not be replaced until all other pages have been replaced (or given second chances). In addition, if a page is used often enough to keep its reference bit set, it will never be replaced.

One way to implement the second-chance algorithm (sometimes referred to as the **clock** algorithm) is as a circular queue. A pointer (that is, a hand on the clock) indicates which page is to be replaced next. When a frame is needed, the pointer advances until it finds a page with a 0 reference bit. As it advances, it clears the reference bits (Figure 10.17). Once a victim page is found, the page is replaced, and the new page is inserted in the circular queue in that position. Notice that, in the worst case, when all bits are set, the pointer cycles through the whole queue, giving each page a second chance. It clears all the reference bits before selecting the next page for replacement. Second-chance replacement degenerates to FIFO replacement if all bits are set.

- 3. Considera file system on a disk that has both logical and physical block sizes of 512bytes. Assume that the information about each file is already in memory.Suppose we use indexed allocation and are currently at the 10th logical block.If we want to access the 3rd logical block, how many disk blocks should weaccess?

  单选题 (10 分)　10分

  ◉ A. 1

- Name three ways in which the processor can transition form user mode to kernel mode?
  - 1. The user process can execute a trap instruction (e.g. system call).A trap is known asa synchronous software interrupt.
    2. The user process can cause an exception (divide by zero, access badaddress, bad instruction, page fault, etc).
    3. The processor can transition into kernel mode when receiving aninterrupt.
- 3. Whichof the following instructions should be privileged(in kernel mode)?

  多选题 (10 分)　10分

  ☑ A. Setvalue of timer

  ☐ B. Readthe clock.

  ☑ C. Clear memory.

  ☐ D. Issuea trap instruction.

  ☑ E. Turn off interrupts.

  ☑ F. Modifyentries in device-status table.

  ☐ G. Switchfrom user to kernel mode.

  ☑ H. AccessI/O device.
-

An alternative to a nonblocking system call is an asynchronous system call. An asynchronous call returns immediately, without waiting for the I/O to complete. The thread continues to execute its code. The completion of the I/O at some future time is communicated to the thread, either through the setting of some variable in the address space of the thread or through the triggering of a signal or software interrupt or a call-back routine that is executed outside the linear control flow of the thread. The difference between nonblocking and asynchronous system calls is that a nonblocking `read()` returns immediately with whatever data are available—the full number of bytes requested, fewer, or none at all. An asynchronous `read()` call requests a transfer that will be performed in its entirety but will complete at some future time. These two I/O methods are shown in Figure 12.9.

- context switch
  - Ingeneral, the operating system must **save the state** of the currently running process and restore the state of the process scheduled to be run next. Saving the stateof a process typically includes the values of all the CPU registers in additionto memory allocation.
  - **Context switches must also perform manyarchitecture-specific operations, including flushing data and instruction caches.**
- 5. Consider the following code segment:

  ```
  pid_t pid;
  pid = fork();
  if (pid == 0) { /* childprocess */
  fork();
  thread_create(. . .);
  }
  fork();
  ```

  a. How many unique processes are created? _____ (包括第一次运行该程序的进程)

  b. How many unique threads are created? _____ (没有主线程)

  请把数值依次填入下面方框内:

  填空题 (8 分) 8 分 (请按题目中的空缺顺序依次填写答案)

  (1) 6

  (2) 2

- 6. Which of the following components of program state are shared across threads in a multithreaded process?

  多选题 (6 分) 6分

  - [ ] A. Register values
  - [x] B. Heap memory
  - [x] C. Global variables
  - [ ] D. Stack memory

- 函数pthread_join用来等待一个线程的结束,线程间同步的操作。头文件： #include <pthread.h>

  函数定义： int pthread_join(pthread_t thread, void **retval);

  描述 ： pthread_join()函数，以阻塞的方式等待thread指定的线程结束。当函数返回时，被等待线程的资源被收回。如果线程已经结束，那么该函数会立即返回。并且thread指定的线程必须是joinable的。

  参数 ： thread: 线程标识符，即线程ID，标识唯一线程。retval: 用户定义的指针，用来存储被等待线程的返回值。

  返回值 ： 0代表成功。 失败，返回的则是错误号。

-

18. 操作系统中提供了一种进程间的通信机制，把一个进程的标准输出与另一个进程的标准输入连接起来，这种机制称为___。

单选题 (3 分)　3分

A. 重定向

B. 管道

C. socket

D. 共享内存

- 23. 以下描述中，_____并不是多线程系统的特长

  单选题 (3 分)　3分

  A. 利用线程并行地执行矩阵乘法运算

  应用中断完成

  B. web服务器利用线程请求http服务

  C. 键盘驱动程序为每一个正在运行的应用配备一个线程，用来响应相应的键盘输入

  D. 基于GUI的应用程序用不同线程处理用户的输入、计算、输出等操作

- 响应比=作业响应时间/作业执行时间=(作业执行时间十作业等待时间)/作业执行时间。高响应比调度算法在等待时间相同的情况下，作业执行时间越短响应比越高，满足短任务优先。随着等待时间增加，响应比也会变大，执行机会就增大，所以不会产生饥饿现象。先来先服务和时间片轮转不符合短作业优先，非抢占式短作业优先会产生饥饿现象。

  高响应比优先调度算法 Highest Response Ratio Next(HRRN)

  - 响应比R = (等待时间 + 要求执行时间) / 要求执行时间

  14. 下列选项中，满足短任务优先且不会发生饥饿现象的调度算法是?

  单选题 (5 分)　5分

  A. 先来先服务

  B. 高响应比优先

  C. 时间片轮转

  D. 非抢占式短任务优先

- 调度相关术语
  - throughput: the number of processes completed per time unit

  - **CPU utilization** : percentage of CPU being busy
  - **Throughput**: # of processes that complete execution per time unit
  - **Turnaround time**: the time to execute a particular process
    - from the time of *submission* to the time of *completion*
  - **Waiting time**: the total time spent waiting in the *ready queue*
  - **Response time**: the time it takes from when a request was submitted until the first response is produced
    - the time it takes to *start responding*

- 3. In the producer-consumer problem, the orderof wait operations cannot be reversed, while the order of signal operations can be reversed.

  判断题 (4 分) 4分

  - A. TURE
  - B. FALSE

- 12. Three processes are synchronizing on a shared code segment which is protected by a semaphore. If at most two processes are allowed to enter the code segment simultaneously, which of the following results shows the possible values that the semaphore may have?

  单选题 (5 分) 5分

  - A. 2, 1, 0, -1
  - B. 3, 2, 1, 0
  - C. 2, 1, 0, -1, -2
  - D. 1, 0, -1, -2

- 8. Banker's algorithm is oneof _____ algorithm。

  单选题 (8 分) 8分

  - A. deadlock recovery
  - B. deadlock avoidance
  - C. deadlock prevention
  - D. deadlock detection

- inverted page table

  4. The BTV operating system has a 21-bitvirtual address, yet on certain embedded devices, it has only a 16-bit physicaladdress. It also has a 2-KB page size. How many entries are there in each ofthe following?
     a. A conventional, single-level page table . Answer:_____ (填写10进制数)
     b. An inverted page table. Answer: _____ (填写10进制数)

  填空题 (16 分) 16 分 (请按题目中的空缺顺序依次填写答案)

  (1) 1024

  (2) 32

- 6. Consider a paging system with the page table stored in memory.
  a. If a memory reference takes 50 nanoseconds, how long does a paged memory reference take?
  b. If we add TLBs, and if 75 percent of allpage-table references are found in the TLBs, what is the effective memory reference time? (Assume that finding a page-table entry in the TLBS takes 2 nanoseconds, if the entryis present.)
  Answer:
  a. 100 ns
  b. 64.5 ns hit time

- EAT

- 给文件创建软链接，为log2013.log文件创建软链接link2013，如果log2013.log丢失，link2013将失效：

```
ln -s log2013.log link2013
```

  4. 若在超级权限下，对当前目录的linux-5.17.1子目录建立一个符号链接文件，该符号链接文件名为/usr/src/linux，应该执行哪个指令?

  单选题 (10 分) 10分

  - A. ln –s /usr/src/linux ./linux-5.17.1/
  - B. ln ./linux-5.17.1/ /usr/src/linux
  - C. ln –s ./linux-5.17.1/ /usr/src/linux
  - D. ln /usr/src/linux ./linux-5.17.1/

- 5. 在安装Linux操作系统时,需要对硬盘分区格式化为特定类型的文件系统，以2020年发布的各种Linux系统发行版本为例,系统使用作为缺省的文件系统类型是___。

  单选题 (10 分) 10分

  - A. FAT32
  - B. NTFS
  - C. ext3
  - D. ext4

- second-chance?

  22. The second-chance (clock) algorithm is anefficient approximation technique for _____.

  单选题 (3 分) 3分

  - A. LRU page replacement
  - B. LFU page replacement
  - C. benchmarking file system performance
  - D. benchmarking raw disk I/O performance

- NRU?

  21. Implementing LRU precisely in an OS is expensive, so practical implementations often use an approximation called .

  单选题 (3 分) 3分

  - A. MRU
  - B. MFU
  - C. LFU
  - D. NRU

- 19. 下述_____页淘汰算法会产生Belady现象。

  单选题 (3 分) 3分

  - A. 先进先出
  - B. 最近最少使用
  - C. 最不经常使用
  - D. 最佳页面置换

- 信号量相关习题
  - https://www.gatevidyalay.com/semaphore-binary-semaphore-practice-problems/

- 3. Operating system for which the NTFS file system was developed _____.

  单选题 (4 分) 4分

  - A. Linux
  - B. DOS
  - C. Unix
  - D. Windows 10

-

7. Commonly, In memory the file control block of a file does not contain_____.

单选题 (4 分) 0分

- A. the access rights
- B. the timestamp
- C. the file size
- D. the file name

Introduction

- ssd，均匀擦除 solid state disk
- 系统调用传递参数：寄存器，内存的block，压栈