Exercise 3 Resource sharing

1. 1. **Explain the difference between private, shared and exclusive resources and give an example of problems encountered in exclusive resources.**

      私有资源由一个进程/线程独占使用，而共享资源可以由至少两个进程/线程使用。独占资源是共享资源中的一类，在使用时压它是由一个进程/线程所独占的，空闲时所有线程都可以去申请这个资源。例如打印机，空闲时是共享的，但是工作是时时独占的，不然会会出现打印错误。

   2. **Propose three ways such that the problem occurring in Resource Sharing Problem of mutual exclusion (mutual exclusion) can be solved.**

      非抢占，禁用中断，信号量。

   3. **Explain the application of a possible solution of the previous part.**

      信号量：

      信号量指出了同时访问共享资源的线程最大数目。它允许多个线程在同一时刻访问同一资源，但是需要限制在同一时刻访问此资源的最大线程数目。一般是将当前可用资源计数设置为最大资源计数，每增加一个线程对共享资源的访问就会发出信号量信号，当前可用资源计数减1，只要当前可用资源计数是大于0的，就可以发出信号量信号。但是当前可用计数减小到0时则说明当前占用资源的线程数已经达到了所允许的最大数目，不能在允许其他线程的进入，线程使用完资源之后发出一个释放资源的信号量信号，使得当前可用资源计数加1。

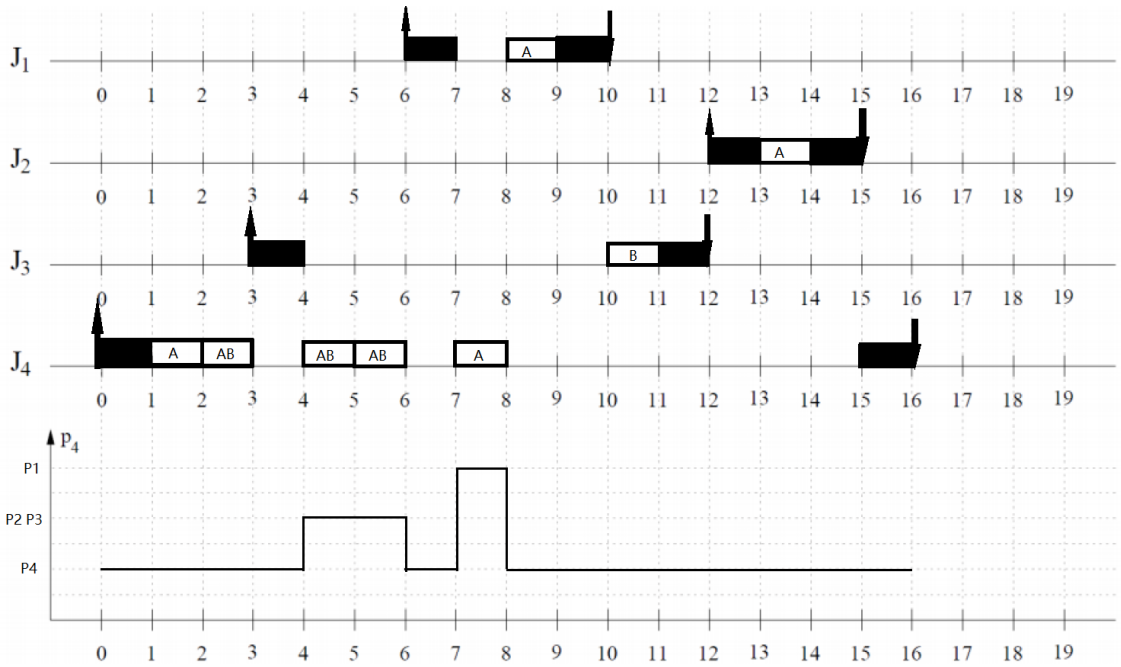
2. 1. **In the lecture you learned about the Priority Inheritance Protocol (PIP). Does the PIP solve the problem of deadlocks? Give a brief explanation for your response.**

      PIP不能防止死锁，例如低优先级线程TL获取信号量S1进入临界区Z1，在执行过程中高优先级线程TH抢占TL并获取信号量S2进入临界区Z2，在Z2中TH申请S1被TL阻塞，TL继承TH优先级继续执行Z1，此时TH需要获取S2，死锁产生。

   2. **Given are the four tasks J1, J2, J3 and J4. The table below contains information on their arrival times, deadlines, their execution time and priorities. The tasks with fixed priorities should be handled by a fixed priority scheduling processor as far as possible within their deadlines.**

   3. **The drawings in the last row of the table provide information about the sequence ofindividual tasks. Each task contains one or more critical sections, in which the system accesses the two exclusive resources A and B, respectively. In the drawings, each block has one unit of length and non-critical sections are shaded. The critical sections are marked with the corresponding letters A and B. For example, the seven time units long task J4 contains two critical sections, the five time periods long section A and the three time units long section B. A and B are nested here, i.e. during the periods 3-5 J4 must have access to both resource A and resource B.**

      Task: Now create a scheduling with the Priority Inheritance Protocol and ll out the chart prepared below. Highlight the critical Portions of the tasks with the letters A and B as specied in the last line of the table . Please also characterized p4 which is the active priority of Task J4 in the given diagram. Note: Pay close attention to the priorities of the individual tasks!



4. **Are all deadlines satisfied through the application of the PIP? If not, how big is the maximum delay (maximum lateness) in units of time?**

   不，J2超时了2个时间单位

5. **Is there a schedule for the tasks specified J1 to J4 that meets all deadlines? What changes should be made to the priority? If there is a correct schedule, please show it in the graph provided below. Otherwise, explain why there can be no correct schedule.**

   存在，但是要改变一个优先级，改为 J4 > J1 > J2 > J3 。