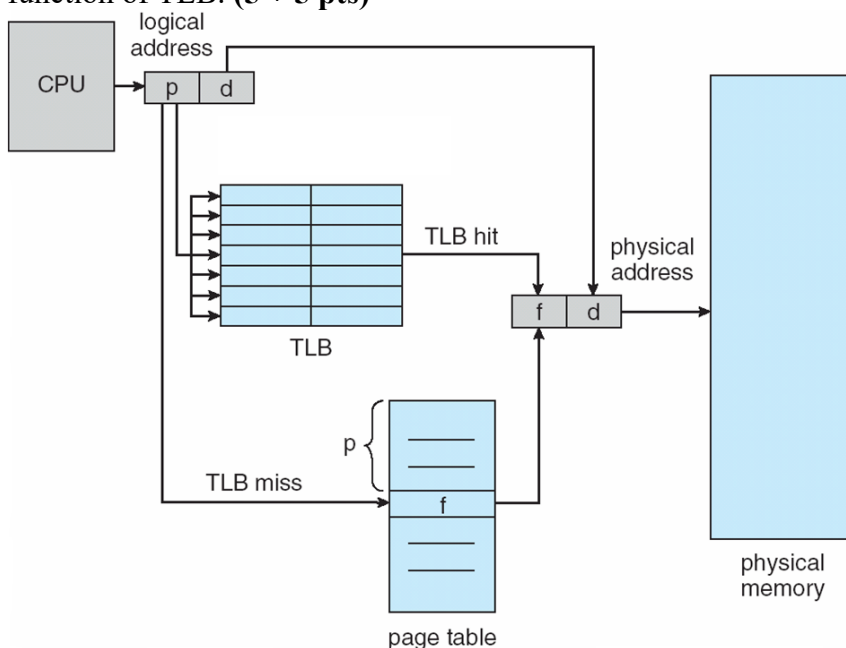


長庚大學109學年度第一學期 資工所博士班資格考試
科目：作業系統

- Consider the following processes, assume that the time unit is one millisecond.
 - Draw the scheduling charts for FCFS (first come first serve) scheduling and non-preemptive SJF (short job first) scheduling **(6 pts)**
 - Derive the average waiting time of each scheduling algorithm. **(4 pts)**

<u>Process</u>	<u>Burst Time (ms)</u>	<u>Ready Time (ms)</u>
P1	3	0
P2	9	1
P3	1	2
P4	2	3
P5	4	4

- Please define the thrashing problem in operating systems. **(10 pts)**
- There is a system with only 3 memory frames. Given a reference string of pages $\{5 \rightarrow 2 \rightarrow 0 \rightarrow 3 \rightarrow 0 \rightarrow 2 \rightarrow 5 \rightarrow 0 \rightarrow 5 \rightarrow 7 \rightarrow 2\}$. Please illustrate the page replacement of (a) the Least Recently Used (LRU) algorithm and (b) the optimal algorithm. You should show the memory frames and the LRU queue for the LRU algorithm. The explanation for each page replacement of the optimal algorithm should be provided. **(5 + 5 pts)**
- The following figure shows the paging hardware with TLB. (a) Please define p, d, and f in the figure and illustrate the process for deriving the physical address. (b) Please briefly explain the function of TLB. **(5 + 5 pts)**



5. For the memory management in operating systems, we might have external fragmentation and internal fragmentation. (a) Please define the external fragmentation and internal fragmentation. (b) If the paging strategy is used for the memory management, is it possible to have internal fragmentation? (You have to provide the reason to support your answer (yes or no)). **(5 + 5 pts)**
6. Synchronization is a fundamental support provided by operation systems to allow multiple processes and/or threads to access shared data. Peterson's Solution is a well-known example provided by OS textbooks. For the second version of Peterson's Solution, as follows, please explain the problem for using the code for processes P_i and P_j . **(10 pts)**

Initially, $\text{flag}[i]=\text{flag}[j]=\text{false}$

<p>P_i :</p> <pre>do { flag[i]=true; while (flag[j]) ; critical section flag[i]=false; remainder section } while (1);</pre>	<p>P_j :</p> <pre>do { flag[j]=true; while (flag[i]) ; critical section flag[j]=false; remainder section } while (1);</pre>
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7. Please define (1) I/O-bound processes **(5 pts)** and (2) CPU-bound processes. **(5 pts)**
8. (15%) Suppose that a disk drive has 5000 cylinders, numbered from 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling algorithms? (a) FCFS (b) SSTF (c) SCAN. **(5 + 5 + 5 pts)**
9. Explain essential properties for each of the following types of operating systems: (a) Batch, (b) Interactive, (c) Time sharing, (d) Real time, and (e) Clustered. **(3 + 3 + 3 + 3 + 3 pts)**