

國立臺灣科技大學  
八十九學年度博士班招生考試試題

系所組別：資訊工程研究所  
科目：計算機系統

1. Assume we have the workload shown below. All five processes arrive at time 0, in the order given.

Process	Burst Time
1	10
2	29
3	3
4	7
5	12

Considering FCFS, Shortest-Job-First, and round-robin (quantum = 10) scheduling algorithms for the set of processes, which algorithm would give the minimum average waiting time? Why? (16%)

2. Please draw a carry save adder for adding four 4-bit numbers (17%)
3. Please design a 4-bit carry-lookahead adder. (17%)
4. A computer whose processes have 512 pages in their address spaces keeps its page tables in memory. The overhead required for reading a word from the page table is 600 nsec. To reduce this overhead, the computer has an associative memory, which holds 16 (virtual page, physical page frame) pairs, and can do a look up in 100 nsec. What hit rate is needed to reduce the mean overhead to 150 nsec? (8%)
5. The clock interrupt handler on a certain computer requires 0.5 msec (including process switching overhead) per clock tick. The clock runs at 100 Hz. What fraction of the CPU is devoted to the clock? (8 %)
6. Functions  $d$  and  $s$  map set of positive integers into set of positive integers. You are given
- $$d(2) = s(2) = 1; d(3) = s(3) = 2;$$
- $$d(n) = d(\lfloor n/2 \rfloor) + 2 \quad \text{if } n \geq 4;$$
- $$s(n) = s(\lfloor n/2 \rfloor) + n - 1 \quad \text{if } n \text{ is odd and } n \geq 5;$$
- $$s(n) = s(n/2) + n - 2 \quad \text{if } n \text{ is even and } n \geq 4.$$
- For integer  $n \geq 2$ , prove
- $$d(n) + s(n) = 2n - 2$$
- and
- $$d(n) = 2 \lfloor \log_2 n \rfloor - 1 \quad \text{if } 2^i \leq n < 3 \times 2^{i-1} \text{ and } i \geq 1;$$
- $$d(n) = 2 \lfloor \log_2 n \rfloor \quad \text{if } 3 \times 2^{i-1} \leq n < 2^{i+1} \text{ and } i \geq 1.$$

You may want to prove the first part by induction. (34 %)

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