※ 考生請注意：本試題 □可 ☑不可 使用計算機

1. To improve the performance of a pipelined processor, two design guidelines are very useful, i.e., to increasing the pipeline depth and to make all pipeline stages balanced. Please explain **in details** how these two guidelines work, respectively. Also, are these two guidelines conflicting to each other in practice? Justify your answers with an illustrative example. (20%)

2. Please explain how a processor handles exceptions (or interrupts) by firstly providing the **definition of exceptions** and raising at least two exception examples. (15%)

3. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

   The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.

   (A) Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, a nonpreemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling. (8%)

   (B) What is the turnaround time of each process for each of the scheduling algorithms in (A)? (6%)

   (C) What is the waiting time of each process for each of the scheduling algorithms in (A)? (6%)

   (D) Which of the schedules in (A) results in the minimal average waiting time (over all processes)? (5%)

(背面仍有題目,請繼續作答)

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4. In computer arithmetic, floating-point addition is not associative; that is, $x+(y+z) != (x+y)+z$. Please explain why this may happen and provide an example to illustrate the difference between computer arithmetic and paper-and-pencil arithmetic.　　　(15%)

5. Consider the following page reference string:

　　　1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.

How many page faults would occur for the following replacement algorithms, assuming one, two, three, four, five, six, or seven frames? Remember all frames are initially empty, so your first unique pages will all cost one fault each.

- LRU replacement
- FIFO replacement
- Optimal replacement　　　(25%)