國立臺灣師範大學 111 學年度碩士班招生考試試題

科目： **計算機系統** 適用系所： **資訊工程學系**

注意：1.本試題共 2 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

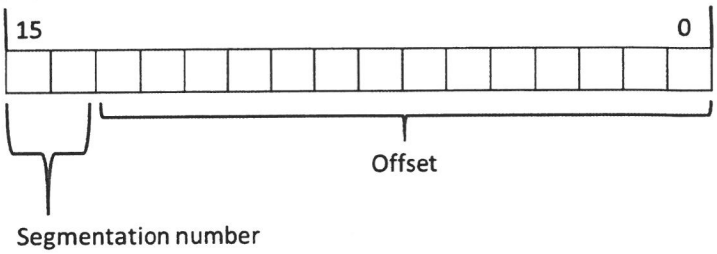
1. (15 points) Describe the two modes of operation in modern operating systems.

2. (10 points) Including the initial parent process, how many processes are created by the program shown below?

```
#include <stdio.h>
#include <unistd.h>

int main(){
   int i;
   for(i=0; i<6; i++)
      fork();
   return 0;
}
```

3. (15 points) Consider the following virtual address format and segmentation table. Determine the physical addresses for the following virtual addresses.



Segment	Base	Length
0	$A400_{hex}$	$1A00_{hex}$
1	$4A00_{hex}$	0300_{hex}
2	$8A00_{hex}$	1250_{hex}
3	2200_{hex}	1000_{hex}

(a) (5 points) 4200_{hex}
(b) (5 points) 9200_{hex}
(c) (5 points) $D200_{hex}$

4. (10 points) Assume that a disk drive has 1200 cylinders, numbered 0 to 1199. The disk drive is currently serving a request at cylinder 350, and the previous request was at cylinder 50. Consider the following queue of pending requests in FIFO order.

118 335 657 1150 1158 190 1165 1149 583 961

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 the following disk scheduling algorithms?

(a) (5 points) FCFS scheduling
(b) (5 points) SSTF scheduling

5. (3 points) Convert the 16-bit hexadecimal number $(C21E)_{hex}$ to binary number.
6. (3 points) In the context of computer architecture, briefly describe the "stored-program concept."
7. (4 points) Consider a cloud-computing system that has the mean-time-to-failure (MTTF) of 600,000 hours and the mean-time-to-repair (MTTR) of 300 hours. Calculate the "availability" of this system, and give the first four decimal places of your result. For example, the first four decimal places of 3.14159 is 1415, and the first four decimal places of 0.876543 is 8765.
8. (6 points) Suppose a program has the execution time = 100 seconds in Computer A, with multiply operations responsible for 70 seconds of this time. Is it possible to make the program run four times faster by improving the speed of the multiplication of Computer A? If you think the answer is YES, state the maximum lower bound of the amount of the needed improvement; if you think the answer is NO, explain.
9. (7 points) Give one reason why, besides the benefit of parallel computing, instead of picking a design of one single very-high-speed processor (e.g., target clock rate = 5.0 GHz), computer architects would favor a design of multiple relatively-low-speed processors.
10. (13 points) Consider a typical five-stage pipelining (i.e., IF, ID, EX, MEM, WB) RISC processor:
    (a) (5 points) Describe the concept of "forwarding" (also known as "bypassing").
    (b) (8 points) Describe a case of two back-to-back instructions that will cause data hazard even though the pipeline has enabled forwarding. You may draw figures to help illustrate the scenario.
11. (14 points) Cache design issues:
    (a) (6 points) Explain the benefit of using the write-back cache scheme.
    (b) (8 points) Describe one advantage AND one disadvantage of the fully associative cache scheme.