國立雲林科技大學 112 學年度
碩士班招生考試試題

系所：資工系
科目：計算機概論(1)

1. For a direct-mapped cache design with a 32-bit address, the following bits of the address are used to access the cache.

Tag	Index	Byte offset
31-16	15-4	3-0

(a) How many entries does the whole cache have? (5%)

(b) In the whole cache, how many bits are used to store tag information? (5%)

2. What were the two major motivations for virtual memory? (5%)
   (a) Remove the programming burdens of a small, limited amount of main memory.
   (b) Enhance task-level and process-level parallelism.
   (c) Allow efficient and safe sharing of memory among multiple programs.
   (d) Reduce the miss rate of a cache.

3. For an 8-bit CPU, what is two's complement representation of -4? (5%)

4. Let processes P_1, P_2, P_3 and P_4 arrive at time 0. The length of CPU burst time of P_1, P_2, P_3 and P_4 is 6, 8, 7 and 3 respectively. Assuming that the shortest-job-first (SJF) scheduling algorithm is adopted to schedule these processes. What is the average waiting time? (5%)

5. Processes P_1 and P_2 are periodic tasks. P_1 has a period of 50 and a CPU burst time of 25. On the other hand, P_2 has a period of 80 and a CPU burst time of 20. What is the total CPU utilization of the two processes? (5%)

6. Suppose that a process is executing "`counter = coutner + 1`" while another process is executing concurrently and independently "`counter = counter - 2`", where the `counter` is a variable shared between the two processes and is accessed only by these two statements once. Given that the initial value of `counter` is 5 before execution, please list all possile values of `counter` after both processes finish. (5%) (提示：共有三種情況，全對才給分，任一個錯誤零分)

7. How many processes are created by the following program? (5%)

```
#include <stdio.h>
#include <unistd.h>
int main()
{
    int i;
    for (i = 0; i < 4; i++)
         fork();

    return 0;
}
```

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8. For the following program, what the output will be at lines C and P? (10%)

```
#include <pthread.h>
#include <stdio.h>
int value = 100;
void *runner(void *param); /* the thread */
int main(int argc, char *argv[])
{
    pid t pid;
    pthread t tid;
    pthread attr t attr;
    pid = fork();
    if (pid == 0) {
        pthread attr init(&attr);
        pthread create(&tid,&attr,runner,NULL);
        pthread join(tid,NULL);
        printf("CHILD: value = %d",value); /* LINE C */
    }
    else if (pid > 0) {
        wait(NULL);
        printf("PARENT: value = %d",value); /* LINE P */
    }
}
void *runner(void *param) {
    value = 50;
    pthread exit(0);
}
```

9. In how many ways can one travel in the xy-plane from (-1, 5) to (-5 , -2) if each move is one of the following three types(10%)

   W: $(x,y) \rightarrow (x-1, y)$,

   S: $(x,y) \rightarrow (x, y-1)$, and

   SW: $(x,y) \rightarrow (x-1, y-1)$?

10. Let F_n denote the nth Fibonacci number, and $F_n = F_{n-1} + F_{n-2}$. Find the smallest Fibonacci number (>1),which is a perfect square.(10%)

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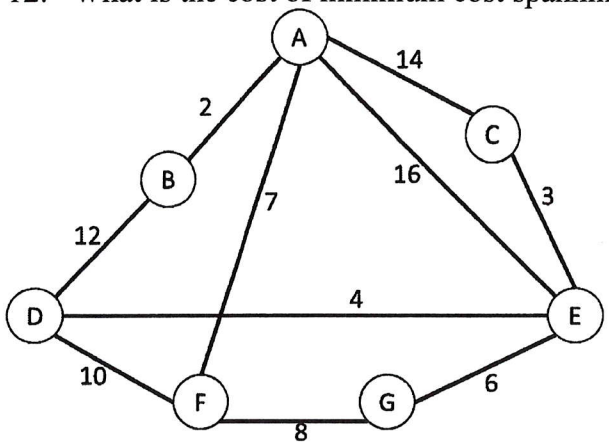
11. Let **u** = (1, 1, 1) and **a** = (0, 2, -1).
    (a) Find the vector component of **u** along **a**.(5%)
    (b) Find the vector component of **u** orthogonal to **a**.(5%)

12. What is the cost of minimum cost spanning tree of the given graph?(10%)



13. Ackerman's function A(m , n) is defined as below:

$$A(m,n) = \begin{cases} n+1 & if\ m = 0 \\ A(m-1,1) & if\ n = 0 \\ A(m-1, A(m,n-1)) & otherwise \end{cases}$$

    (a) What is the value of A(2, 1)?(5%)
    (b) Write a recursive program to calculate A(m, n).(5%)