

Question 1

The Golomb sequence is the series of numbers 1, 2, 2, 3, 3, 4, 4, 4, Specifically, we have

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	...
n th number	1	2	2	3	3	4	4	4	5	5	5	6	6	6	6	7	...

Formally, the n th Golomb number, where $n = 1, 2, 3, \dots$, is computed by

$$f(1) = 1 \text{ for } n = 1$$

$$f(n) = 1 + f(n - f(f(n - 1))) \text{ for } n \geq 2$$

Write a C program named **p1.c** using the **fork()** system call that generates the Golomb sequence in the child process. The number n will be provided in the command line, where $n \geq 1$. For example, if $n = 4$ is provided, the numbers 1, 2, 2, 3 in the Golomb sequence will be output by the child process. Because the parent and child processes have their own copies of the data, it will be necessary for the child process to output the Golomb sequence by calling the user-defined function **PrintGolomb()**. Have the parent invoke the **wait()** system call to wait for the child process to complete before exiting the program. Perform necessary error checking to ensure that a positive integer n is passed on the command line.

Hint: You may define a function **Golomb(n)** to return the n th number in the Golomb sequence.

Question 2

a

Consider the following program:

```
main (int argc, char ** argv) {
    int child = fork();
    int x = 100;

    if (child == 0) {
        x -= 10;
    }
    else {
        child = fork();
        x -= 20;
        if (child) {
            x -= 10;
        }
    }
}
```

How many different copies of the variable x are there? What are their values when their process finishes?

- b) In systems that have processes with multiple threads, thread scheduling differs depending on whether user-level threads or kernel-level threads are used. Distinguish between these two approaches with the use of an example. Give an advantage of each approach. [5]
- c) Write assembly pseudocode to illustrate how the TSL instruction can be used to achieve mutual exclusion. Briefly explain your code. [4]
- d) (i) What is the main defect of both Peterson's solution and the solution given above using the TSL instruction? [1]

Submission Instructions

- Group assignment (5 students)
- Implement your program for question 1 on the UNIX-like platform such as Ubuntu Linux or Mac OS X by using the C programming language
- The source code must be appropriately commented and structured to allow users to understand your code easily.
- A pdf document is required for your answer to question 2.
- Upload a zipped file containing your source file and pdf to myelearning
- Ensure that student ID and name of group members are listed.