Marmara University - Faulty of Engineering

Department of Computer Engineering

CSE3038 Computer Organization and Architecture (Spring 2024)

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MIPS 32 Problems

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Sections Of the Report: -

Section (1): Problem (1)

This program is designed to calculate the nth element of a sequence defined by a recurrence relation.

Here's a brief explanation of how the program works:

1. It prompts the user to enter the coefficients 'a' and 'b', as well as the first two numbers of the sequence ('x0' and 'x1'), and the number 'n' indicating which element of the sequence to calculate.
2. Then, it enters a loop to calculate the nth element of the sequence based on the given coefficients and initial values.
3. It calculates subsequent elements of the sequence using the recurrence relation mentioned in the project sheet, until it reaches the nth element.
4. Finally, it prints out the result, indicating which element of the sequence was calculated and its value.

The program utilizes MIPS assembly language to achieve these steps, with appropriate system calls for input and output operations.

Section (2): Problem (2)

This algorithm iteratively scans through an array, checking adjacent elements. If the greatest common divisor (gcd) of two adjacent elements is not 1, it replaces the first element with their least common multiple (lcm). It then shifts the subsequent elements leftward and reduces the array length.

Section (3): Problem (3)

This algorithm takes a substring of a given length and swaps its first half with its second half recursively for a given number of times, specified by the parameter n. It first divides the substring into two halves and stores the first half in a temporary array. Then, it swaps each character between the first and second halves iteratively. After that, it recursively calls itself on both halves with a reduced length and decremented n. This process repeats until n reaches 0 or less. The swapping occurs in place, utilizing pointer arithmetic to access different parts of the substring. The algorithm thus effectively performs multiple swaps of the halves of the substring according to the specified number of iterations.

Section (4): Problem (4)

This program is designed to find the number of 1s in the largest island in a given matrix and print the result.

Here's a brief explanation of how the program works:

1. It starts by loading the number of rows and columns of the matrix from memory.
2. Then, it prints the matrix to the console using a function called **print_matrix**.
3. After printing the matrix, it traverses through each element of the matrix using a loop.
4. While traversing, it is called a Depth-First Search (DFS) function to explore the island starting from each 1 encountered.
5. The DFS function recursively visits adjacent cells to mark them as visited (set to 0) and explores further if the adjacent cell is also a part of the island.
6. After DFS exploration, it prints the number of 1s in the largest island to the console.

The program utilizes MIPS assembly language to implement these steps, with appropriate system calls for input and output operations.