Project Report

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Problem Statement 1

Given a positive integer n , we have to calculate the sum of the series 1^1+2^2+3^3...+n^n

Algorithm:

Lets say func(n) is a recursive function which calculates the sum of the series

Recursive function :

func(1)=1;   // base case
func(n)=func(n-1)+n^n;

MIPS implementation:

- We prompt user to input n and store n in $a0
- Then we will call the function Find_sum by passing the parameter $a0 , and storing $a0 in $s0
- Then we will call the function power_n which will calculate the value of n^n and stores it in $t2
- We use $v0 to store and update sum of series in each step as, $v0=$v0+$t2
- The final value stored in $v0 after the function ends will be returned

Example:

Input: n = 2
Output: 5

```
  Find_sum(2)
  $t2=1
  while($t2<n)
     $t2=power_n(n)
     $v0=$v0+$t2
$v==5
```

Hence the final answer is 5

Problem Statement 2

Given a positive integer N, we define the Collatz sequence corresponding to N as the numbers formed by the following operations:
If N is even, $N \leftarrow N/2$ and if N is odd, $N \leftarrow 3N + 1$.
We have to find the number of steps required to reach 1 from N in the Collatz sequence corresponding to N.

Algorithm

func(n)=(n/2)+1 ; if(n%2==0)
func(3*n+1) +1 ; if(n%2==1)

MIPS implementation:

- We prompt user to input n and store n in $a0
- Then we will call the function Collatz_Conjecture: by passing the parameter $a0 , and storing $a0 in $s0
- We will check if n is even or odd, if n is even we will call the function even: which will calculate f(n/2)+1 and if n is odd, we will call the function odd: which will calculate f(3*n+1)+1
- Function Collatz_Conjecture: will return 0 when n=1(base case)
- The final value returned by Collatz_Conjecture: will be printed

Example:

Input: n=10
Output :6

How the recursion works for :f(10)

10 is even , f(10)=f(5)+1;
5 is odd , f(5)=f(16)+1;
16 is even, f(16)=f(8)+1;
8 is even , f(8)=f(4)+1;
4 is even , f(4)=f(2)+1;
2 is even , f(2)=f(1)+1;
f(1)=0; //base case

Hence f(10)=1+1+1+1+1+1=6