

# CS 341 Assignment 2

## MIPS - II

Deadline: 06/09/21 05:00 PM

1. Write a MIPS program to do the following:  
The program should take as input two **integers**  $n$  and  $r$  from the user

The program should compute  ${}^nC_r$  using the following recursive formulation:

$${}^nC_r = {}^{n-1}C_{r-1} + {}^{n-1}C_r$$

The program should then display this value on the screen.

Your program should include at least one non-leaf subroutine.

Your program should prompt the user for input and display the output as shown below.

**Constraints:**  $n \geq 1, r \geq 0$ .

**Sample run:**

Enter n: 25

Enter r: 4

25C4: 12650

Wish to continue?: Y

Enter n: 24

Enter r: 9

24C9: 1307504

Wish to continue?: N

Output by your program is in **blue color**.

**Caution:** Using any other method to calculate  ${}^nC_r$  will fetch you negative marks.

2. Write another MIPS program which does the following:  
The program takes as input two coprime **integers**  $a$  and  $m$  from the user.

The program should compute the modular multiplicative inverse of  $a$  under modulo  $m$ , i.e., find an integer  $x \in [1, m)$  such that

$$ax \equiv 1 \pmod{m}$$

The program then prints the value of  $x$ . (see sample run below)

For computing modular multiplicative inverse, implement the Extended Euclidean algorithm in MIPS to find **integers**  $x$  and  $y$  such that:

$$ax + my = 1 \quad (\gcd(a, m) = 1)$$

$\Rightarrow x \pmod{m}$  will give the modular multiplicative inverse of  $a$  under modulo  $m$ .

Your program should include the use of subroutines.

**Constraints:**  $a \geq 1$ ,  $m \geq 2$  and  $\gcd(a, m) = 1$

**Sample run:**

Enter a: 5  
Enter m: 26  
 $5 \cdot 21 = 1 \pmod{26}$   
Wish to continue?: Y

Enter a: 9  
Enter m: 37  
 $9 \cdot 33 = 1 \pmod{37}$   
Wish to continue?: N

Output by your program is in **blue color**.

**Caution:** The naive approach of trying all numbers from 1 to  $m-1$  will fetch you negative marks.

**Submission Format:**

Create a directory with name **<roll\_number>\_A2** consisting 2 files **q1.s** and **q2.s**.  
Compress the directory to **<roll\_number>\_A2.zip** and then upload. (Please use 'zip' format only.)

**Example:**

```
180050076_A2.zip
|----180050076_A2
|      |---- q1.s
|      |---- q2.s
```

Please review your directory structure before submission.