ESc101N: Fundamentals of computing(Lab Session 9)

October 15, 2009

Instructions

1. Please read the question carefully and write the program accordingly
2. Make sure that the TA has graded you program
3. The marks are distributed as follows. You get 60% of the marks if the basic algorithm is current, 20% if you manage to compile and execute and 20% for writing the code cleanly, i.e. using proper variable names, intending and making the code more readable.

An interesting theorem on binomial coefficeints modulo a prime is the Lucas theorem which is given below.

Theorem 1 (Lucas theorem). *Let p be any prime. Let $n = n_0 + \ldots + n_k p^k$ and $m = m_0 + \ldots + m_k p^k$ be the expansions of n and m in base p. Then*

$$\binom{n}{m} = \binom{n_0}{m_0} \cdot \binom{n_1}{m_1} \ldots \binom{n_{k-1}}{m_{k-1}} \binom{n_k}{m_k} \mod p.$$

Question 1. (a) (5 marks) Use Lucas theorem to give an efficient function `nChooseMmod2(n,m)` that computes $\binom{n}{m} \mod 2$.

(b) (5 marks) Use the above function to print the Pascals triangle modulo 2. Recall that the Pascals triangle (mod 2) of height n consists of $n+1$ lines of integers 0 and 1 where for $1 \leq r \leq \ell \leq n$, the $r+1$st integer in the $\ell+1$st line is the value of $\binom{\ell}{r} \mod 2$.

Sample output.

```
$ ./pascal
enter the height of the pascals triangle: 25
1
11
101
1111
10001
110011
1010101
11111111
100000001
1100000011
10100000101
111100001111
1000100010001
11001100110011
101010101010101
1111111111111111
```

```
10000000000000001
110000000000000011
1010000000000000101
11110000000000001111
100010000000000010001
1100110000000000110011
10101010000000001010101
111111110000000011111111
1000000010000000100000001
11000000110000001100000011
```

Question 2. (0 marks) (Not to be graded). Print the pascals traingle for large n on your xterm. Make the font of your terminal really small and make it full screen.