

Lottery Jackpot Probabilities and Odds

There are many lottery schemes available across the world. Write a MIPS Assembly language program that will calculate the odds of winning the Jackpot prizes.

For example:

- The **Euro Millions** lottery requires matching 5 numbers from a pool of 50 numbers and matching 2 numbers from a second pool of 11 numbers.
- The **Mega Millions** lottery requires matching 5 from 70 and 1 from 25.
- The **Thunderball** lottery requires matching 5 from 39 and matching 1 from 14.
- The **PowerBall** lottery requires matching 5 from 69 and 1 from 26.

The subroutine example on the following page, calculates the Factorial of an input integer. Factorials are used to calculate the odds for the lottery jackpots. You may use the code in the example in writing your MIPS - QtSpim assembly language program that:

- 1) Calculates the odds of winning each of the lottery jackpot grand prizes.
- 2) The calculated value is to be displayed on the QtSpim console screen with an appropriate commentary text. Such as “The odds are 1 in nnnn.”
- 3) The program is to accept as input from the user, four values:
 - An integer representing the large pool of possible numbers.
 - A second integer representing the count of numbers to be selected from the large pool.
 - An integer representing the size of the second smaller pool of numbers.
 - A fourth integer representing the count of numbers to be selected from the second pool.
- 4) Test your program by calculating the odds of choosing a set of 8 numbers from a pool of 15 numbers, and 1 from 2, small pool. The value is “1 in 12870”.

Note: The largest MIPS single precision integer value will not hold the value of more than 12! Therefore you will need to use some algebra to simplify the calculations. With the simplifications, all of the math can be and must be done using the integer multiply and divide instructions.

Your program must display a message when it stops.

Use the System Service calls on page A-44 of the textbook for the input and output.

The work products of this assignment are:

- 1) A copy of the source program text file. (.txt; or .asm; or .s)
- 2) Screen captures showing your test output results.

[150 points]

```
##### Factorial Subroutine Fall 2016
#
# Given n, in register $a0;
# calculate n!, store and return the result in register $v0

factrl:    sw    $ra, 4($sp)    # save the return address
           sw    $a0, 0($sp)    # save the current value of n
           addi  $sp, $sp, -8    # move stack pointer
           slti  $t0, $a0, 2    # save 1 iteration, n=0 or n=1; n!=1
           beq   $t0, $zero, L1  # not less than 2, calculate n(n-1)!
           addi  $v0, $zero, 1   # n=1; n!=1
           jr    $ra            # now multiply

L1:        addi  $a0, $a0, -1    # n = n-1

           jal   factrl         # now (n-1)!

           addi  $sp, $sp, 8     # reset the stack pointer
           lw    $a0, 0($sp)     # fetch saved (n-1)
           lw    $ra, 4($sp)     # fetch return address
           mul   $v0, $a0, $v0   # multiply (n)*(n-1)
           jr    $ra            # return value n!

# P Snyder 14 August 2016
##### End of the subroutine
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August 2018