ES 112 First Midterm Examination
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Fall 2003-2004

1 A Game of Dice

Two friends have decided to play a game of dice. They have decided that the game will be played as follows: Player A will roll one six-sided die until he manages to roll a six. Then, player B will also roll one die until he gets a six, too. The player to roll a six in fewer number of rolls will be the winner. If the number of rolls of the two players are equal, they will call it a draw.

Your task in this problem is to write a C program that will simulate this game, and print how the game proceeds and how it ends. Output from a sample run should look as follows:

```
Player A rolls: 3 2 1 3 5 2 6
Player A rolled a six in 7 tries.

Player B rolls: 1 4 2 3 6
Player B rolled a six in 5 tries.

Player B wins!
```

Or, in case of a draw:

```
Player A rolls: 3 5 2 6
Player A rolled a six in 4 tries.

Player B rolls: 4 2 3 6
Player B rolled a six in 4 tries.

The result is a draw.
```

You should try to match the output of your program as closely as possible to the samples here, including newlines and blank lines.

2 The Harmonic Sum

The n^{th} harmonic sum, H_n is defined to be:

$$H_n = \sum_{k=1}^{n} \frac{1}{k}$$

So, for example:

$$\begin{aligned} H_1 = 1/1 &= 1.0 \\ H_2 = 1/1 + 1/2 &= 1.5 \\ H_3 = 1/1 + 1/2 + 1/3 &= 1.8333 \\ H_4 = 1/1 + 1/2 + 1/3 + 1/4 &= 2.0833 \end{aligned}$$

a. Write a C *function* that takes one `integer` argument `n`, and returns the `n`th harmonic sum as a `double`. In other words, the prototype of the function should be:

```
double harmonicSum(int n);
```

b. Write a C program that uses the above function (assume the function is typed at the bottom of the file; do not write it again!) to do the following: Ask the user for an integer. If the user enters a positive integer, display the harmonic sum with the number the user has typed and go back and ask for another integer. If the user enters zero or a negative integer, terminate the program.

A sample output of the program should be as follows:

```
Enter an integer (0 to end): 1
The harmonic sum of 1 terms is: 1.0000

Enter an integer (0 to end): 4
The harmonic sum of 4 terms is: 2.0833

Enter an integer (0 to end): 0
```

The output should print only four decimal places, as shown in the sample output. Again, you need to match the output of your program as closely as possible to the sample output, including newlines and blanks.