Gillian Covillo & Joshua Perez 03-20-2020

Pthread Report

**Outside Main:**

The first 3 lines of the code import the libraries needed for the code to run; including the standard library, the standard input/output library (to get input from the user), and the pthread library. The next three lines (that are not blank) are used to initialize global variables that can be used throughout the code. Lb and ub, standing for the lower bound and upper bound respectively, are used to help split the pthreads into semi-equal parts when summing them as broken-up sections. The next part following this is a single line section which initializes the runner method which takes 1 void parameter.

**Main:**

The following section is encapsulated in the main function. The main function takes 2 arguments, the first being an object of type int, called argc, and then a pointer to an array. This (the array) in fact is a neat way to get multiple inputs from the user in the command line as opposed to having to use direct scanf and printf statements to get the user input. First, the pthread attributes are initialized and give the default attributes. Then, the variable names, N and M, are assigned respectively to the first and second command line arguments that were declared in the argv array. The third line of the main statement initializes a ‘tid’, which is the id of a thread, and declares it of type thread\_t. It is assigned to the size of M, which again is how many threads the user wants to create. The variable q is set to equal N/M, and was initialized to int so that it is basically the same as floor division, in order to get an equal distancing number for all but the last thread, which needs to be either of an equal distance as the previous threads or what ever the remainder is. The remainder is done by doing the modulo of N and M and set to the variable rem.

The for loop is used to create as many threads as specified by the user and to set a lower bound and upper bound for each thread. In order to find the lower bound and upper bound three cases were used. The first is for the initial thread, which will always have a lower bound set to 1 and therefore an upbound only q-1 distance away. The second is last thread to be created, where the upper bound is the user specified N, and the lower bound calculated using both q, ub, and rem. The last case is used for all other threads (other than first and last) which also have respective formulas for finding lower bound and upper bound.

Outside the for loop, the first statement creates a new thread. The pthread\_create statement takes four arguments, the first being a pointer to the pid, i.e. pthread id. The id, in this instance, is the address of the i-number (0-M) pthread stored in the pid array declared earlier. The second argument is used to link the pthread\_attr (pthread attributes) which were declared at an earlier stage. The next argument, runner, is the function that each thread must go through during creation and will be explain more in the following section. The last argument is the address of the i variable, which is then passed to the runner function. The pthread join statement then joins the thread specified in the first argument with the previously terminated thread. The second argument was specified to Null because global variables were used to update the final sum (holder) to get the final sum to print at the end. Therefore, a return value did not need to be specified to be passed between the threads as the second join statement. Finally, the last print statement prints the final summation of 1 to the specified destination, having used all the pthreads to update the holder to find the final sum.

**Runner:**

**First two lines of runner???**

The runner function is broken into two parts, the first if statement checks if i, the pthread iterative, is on its last run (last pthread creation). If it is, then it follows the steps to calculate the sum, print the sum, and update the holder; since finding the sum is slightly different since it may not be at the same equal distance from lower bound to upper bound as the other pthreads. The last else statement then also calculates, using a different formula, the sum, prints it, and updates the holder.