Operating System 1
Report - Programming Assignment - 2
Vaishnavi W AI20BTECH11025

1. Design

- All the necessary header files are included in the code. Global array is created.
- The input - the number n and the number of threads k is stored in the input.txt file.
- The program first opens the input file and reads from it.
- An array of pthreads is created and an array of structs arguments is created which has the arguments to be passed to each thread for the find_perfect_num function. Size is allocated to the struct using malloc.
- Integers 1 - N are divided into K parts, one for each thread. First k-1 threads have $ceil\left[\frac{n}{k}\right]$ numbers and the last thread has the remaining, i.e $\left(n - ceil\left[\frac{n}{k}\right]\right)$.
- The first integer and the total number of integers for a thread is passed as the parameter along with thread number. The changes will be made in the global array
- The function find_perfect_num checks if each of the numbers in the range start to (start + size) are perfect numbers and writes to a log file.
- find_perfect_num()
    - It takes a void pointer as an argument. A pointer to struct item is passed to it.
    - The first integer and the total number of integers are taken from the struct and the range is found to be (start to start + itemsize)
    - Loop is run through the given range of numbers and sum is initialized to zero each time
    - In each loop for each number another loop from 1 to the number is run to check for all its factors.
    - When a factor is found, it is added to the sum variable. If the sum value equals the number - the number is a perfect number. Then the value of global array ‘globarr’ is changed to 1 at that index.
    - After looping through all the numbers, the results are written to a log file. It is named as ‘OutFile<threadnum>.log’
    - It returns a NULL pointer.
- As after completion of execution of each thread a log file is created, we have k log files, one log file for each thread.

- Later all the threads are joined and the consolidated result of them is written in a main log file.
- For naming the files, strcat() is used for concatenation and sprintf() to convert int to string. For opening and closing the files, fopen() and fclose() are used. For writing to and reading from files, fprintf() and fscanf() are used.

2. Output
    - Output is printed only if the given numbers are positive integers. Else the program will be terminated with an error message.
    - In each of the log files created by each thread, the information about the perfectness of the all numbers assigned to each thread is written.
    - The format is: Number<x> Is a perfect number/Not a perfect number
    - Each number is checked if it is perfect or not from the global array ‘gloabarr’. If the value is 1, it is written as a perfect number and if 0, then not a perfect number.
    - In the main function, unlike the log files of the threads, only the perfect numbers are printed along with the thread number it belongs to.
    - The format is: Thread<threadnum>: <perfectnum1> <perfectnum2>....
    - If no perfect number is found in the range specified to the thread, it is left blank.