**Kennesaw State University**

**CSE 3502 Operating Systems**

**Project 2 - Pthread**

Instructor: Kun Suo

Points Possible: 100

Difficulty: 

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Description automatically generated

Given two character strings s1 and s2. Write a Pthread program to find out the number of substrings, in string s1, that is exactly the same as s2.

For example, suppose number\_substring(s1, s2) implements the function, then number\_substring(“abcdab”, “ab”) = 2,

number\_substring(“aaa”, “a”) = 3,

number\_substring(“abac”, “bc”) = 0.

The size of s1 and s2 (n1 and n2) as well as their data are input by users. Assume that

n1 mod NUM\_THREADS = 0

and

n2 < n1/NUM\_THREADS.

The following is a sequential solution of the problem. read\_f() reads the two strings from a file named “string.txt and num\_substring() calculates the number of substrings.

<https://github.com/kevinsuo/CS3502/blob/master/project-pthread.c>

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#include <stdlib.h>

#include <stdio.h>

#include <string.h>

#define MAX 10240

**int** total = **0**;

**int** n1,n2;

**char** \*s1,\*s2;

**FILE** \*fp;

**int** **readf**(**FILE** \*fp)

{

**if**((fp=fopen("strings.txt", "r"))==NULL){

printf("ERROR: can't open string.txt!**\n**");

**return** **0**;

}

s1=(**char** \*)malloc(**sizeof**(**char**)\*MAX);

**if**(s1==NULL){

printf("ERROR: Out of memory!**\n**");

**return** -**1**;

}

s2=(**char** \*)malloc(**sizeof**(**char**)\*MAX);

**if**(s1==NULL){

printf("ERROR: Out of memory**\n**");

**return** -**1**;

}

/\*read s1 s2 from the file\*/

s1=fgets(s1, MAX, fp);

s2=fgets(s2, MAX, fp);

n1=strlen(s1); /\*length of s1\*/

n2=strlen(s2)-**1**; /\*length of s2\*/

**if**(s1==NULL || s2==NULL || n1<n2) /\*when error exit\*/

**return** -**1**;

}

**int** **num\_substring**(**void**)

{

**int** i,j,k;

**int** count;

**for** (i = **0**; i <= (n1-n2); i++){

count=**0**;

**for**(j = i,k = **0**; k < n2; j++,k++){ /\*search for the next string of size of n2\*/

**if** (\*(s1+j)!=\*(s2+k)){

**break**;

}

**else**

count++;

**if**(count==n2)

total++; /\*find a substring in this step\*/

}

}

**return** total;

}

**int** **main**(**int** argc, **char** \*argv[])

{

**int** count;

readf(fp);

count = num\_substring();

printf("The number of substrings is: %d**\n**", count);

**return** **1**;

}

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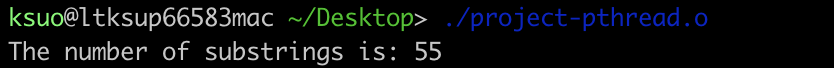
You can find an example of the “string.txt” here:

string.txt: <https://github.com/kevinsuo/CS3502/blob/master/strings.txt>

To compile the program with Pthread, use:

$ gcc project-pthread.c -o project-pthread.o -pthread

One possible output:



(Different string text files, output is also different. For the above strings.txt, the output is 55)

Download the string.txt:

$ wget https://raw.githubusercontent.com/kevinsuo/CS3502/master/strings.txt

Write a parallel program using Pthread based on this sequential solution. Please set the thread number as 10 in your code. You can start with this template code:

<https://github.com/kevinsuo/CS3502/blob/master/parallel-template.c>

To compile the program with Pthread, use:

$ gcc file.c -o file.o -pthread

Here file refers to your source code name.

Expected output with your name (the thread order can be random), suppose the student’s name is Sisi:

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Description automatically generated

HINT: Strings s1 and s2 are stored in a file named “string.txt”. String s1 is evenly partitioned for *NUM\_THREADS* threads to concurrently search for matching with string s2. After a thread finishes its work and obtains the number of local matchings, this local number is added into a global variable showing the total number of matched substrings in string s1. Finally, this total number is printed out. Please make sure the number of substrings of parallel program is the same as the serial program.

HINT: A corner case. When search “is” using multiple threads, please do not ignore corner case like below. The substring “is” could be split into two parts when searched by two threads. Make sure your program can deal with it.

**Submission**

Submit your assignment file through D2L using the appropriate link.

The submission must include the ***source code***, and ***a report describe your code logic****.* ***Output screenshot of your code*** should be included in the report.