

Kennesaw State University

CSE 3502 Operating Systems – Spring 2020

Project 2 - Pthread

Assignments

Assignment 1: (100 points)

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 $n1 \bmod \text{NUM_THREADS} = 0$ and $n2 < n1/\text{NUM_THREADS}$.

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-2-1.c>

```
-----  
#include <stdlib.h>  
#include <stdio.h>  
#include <string.h>  
  
#define MAX 1024  
  
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(s2==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;
}

```

Write a parallel program using Pthread based on this sequential solution.

To compile the program with Pthread, use:

`$ gcc program.c -o program.o -pthread`

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. You can find an example of the “string.txt” in the attached source code.

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

Instruction examples to set multicore for local VMs

(1) Shutdown your VM and change to VM setting to use 4 vCPUs.

(2) Verify that you VM has 4 vCPUs:

```
$ cat /proc/cpuinfo
```

You should have 4 CPUs (processor: 0-3).

Submitting Assignment

Submit your assignment zip file through D2L using the appropriate assignment link. For assignment 1, please submit the *source code*, *screenshot of output* and *a report* with your code logic and analysis included.