

Advanced Unix Programming  
Assignment-6  
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**Q1:Write a program to take input from user for number of files to be scanned and word to be searched. write a multi threaded program to search the files and return pattern if found.**

**Program:**

```
1 #include <dirent.h>
2 #include <pthread.h>
3 #include <string.h>
4 #include <stdio.h>
5 int file_index = 0;
6 struct params {                                /*Parameters struct*/
7     char file_names [255];
8     char word[255];
9 };
10 void *search(void *args) {                      /*thread function*/
11     struct params *temp = args;
12
13     FILE *fp;
14     char line[255]="";
15     fp = fopen(temp->file_names, "r");
16
17     if(fp == NULL){
18         perror("Error: File open failure.");
19     }
20     else{
21         while(fgets(line,255, fp)){              /*read and tokenize each line and search using strstr() */
22             char *token = strtok(line, " \t");
23             while (token != NULL){
24                 if (strstr(token,temp->word) != NULL){
25                     printf("Pattern found:[ %s ] in file %s \n", strstr(token,temp->word), temp->file_names);
26                     fclose(fp);
27                     return (void*) 1;
28                 }
29                 token = strtok(NULL, " \t");
30             }
31         }
32     }
33     fclose(fp);
34     return (void*) 0;
35 }
36 int main(int argc, char const* argv[]) {
37     void *result;
38     char dir_path[255];
39     char word[255];
40     DIR * dir_pointer;
41     struct dirent * entry;
42     int count;
43     printf("Enter the path of dir containing all files:");
44     scanf("%s",dir_path);
45     printf("Enter number of files to be scanned:");
46     scanf("%d",&count);
47     printf("Enter word to be searched:");
48     scanf("%s",word);
49     struct params pars[count];
50     pthread_t threads[count];
51
52     if ((dir_pointer = opendir(dir_path)) == NULL) {
53         printf("can't open directory\n");
54         return 0;
55     }
56     while( (entry = readdir(dir_pointer)) != NULL){
57         if(entry->d_type == DT_REG){              /*access only regular files i.e avoid the . and .. dir */
58             char full_path[255];
59             full_path[0] = '\0';
60             strcat(full_path, dir_path);          // concatenate file directory;
61             strcat(full_path, entry->d_name);      // concatenate filename;
62             strcpy(pars[file_index].file_names, full_path); // store file name into file_names array;
63             strcpy(pars[file_index].word,word);
64             pthread_create(&threads[file_index], NULL, search, &pars[file_index]); //create thread for each file
65             file_index++;
66         }
67     }
68     for(int i = 0; i < count; i++){
69         pthread_join(threads[i],&result);
70         if((int*)result)
71             return 0;
72     }
73     printf("Word not found..!!!\n");
74     return 0;
75 }
```

## Output:

### \*Initial contents of files:

```
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC: ~/Desktop/data
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop$ ls data
file1 file2 file3
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop$ cd data/
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop/data$ cat file1
Maharashtra is the wealthiest state by GDP and also the most industrialized state in India. It is one of the most developed states in India, contributing 25% of the country's industrial output and 23.2% of its GDP (2010-11).[7] As of 2011, the state had a per capita income of ₹1.0035 lakh (US$1,600), more than the national average of ₹0.73 lakh (US$1,100). Its GDP per capita crossed the ₹1.20 lakh (US$1,900) threshold for the first time in 2013, making it one of the richest states in India. However, as of 2014, the GDP per capita reduced to ₹1.03 lakh (US$1,600).[8]
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop/data$ cat file2
Considered to be the cultural capital of Maharashtra,[14] Pune is known as "Oxford of the East" due to the presence of several well-known educational institutions in the city.[15][16] The city has emerged as a major educational hub in recent decades, with nearly half of the total international students in the country studying in Pune.[17] Since the 1950s and 1960s, Pune has had a traditional old-economic base as most of the old industries continue to grow. The city is known for its manufacturing and automobile industries, as well as for research institutes of information technology (IT), education, management and training
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop/data$ cat file3
College of Engineering, Pune COEP PUNE is an autonomous engineering institute affiliated to Savitribai Phule Pune University in Pune, Maharashtra, India. Established in 1854, it is one of the oldest engineering colleges in Asia, after College of Engineering, Guindy Chennai (1794) and IIT Roorkee (1847).[2][3][4] The students and alumni of College of Engineering, Pune are colloquially referred to as COEPians.[5] The college's study model was referred to, in the early 1950s, as the "Poona Model".
```

### \*CASE 1: Searching a word which is completely present and Searching a word which is present in a pattern.

```
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC: ~/Desktop
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop$ cc a6q1.c -lpthread
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop$ ./a.out
Enter the path of dir containing all files:./data/
Enter number of files to be scanned:3
Enter word to be searched:COEP
Pattern found:[ COEP PUNE ] in file ./data/file3
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop$ ./a.out
Enter the path of dir containing all files:./data/
Enter number of files to be scanned:3
Enter word to be searched:cultural
Pattern found:[ cultural ] in file ./data/file2
```

### \*CASE 2: Searching a word which is not present in any of the files.

```
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop$ ./a.out
Enter the path of dir containing all files:./data/
Enter number of files to be scanned:3
Enter word to be searched:VIJESH
Word not found..!!!
```

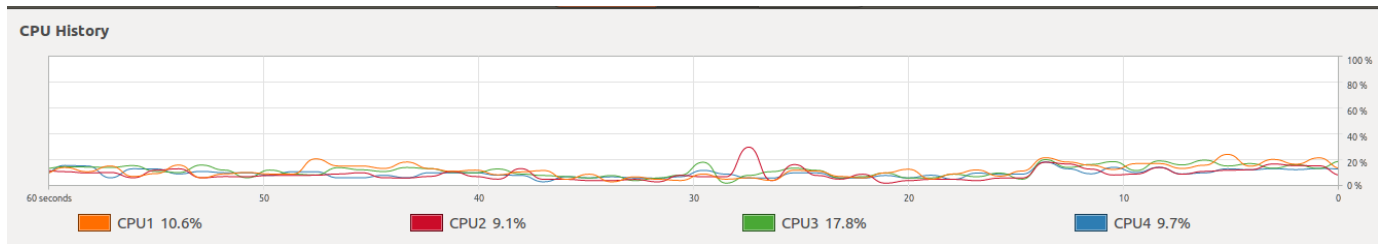
Q2. Write a program to find number of CPUs, create that many threads and attach those threads to CPUs

Program:

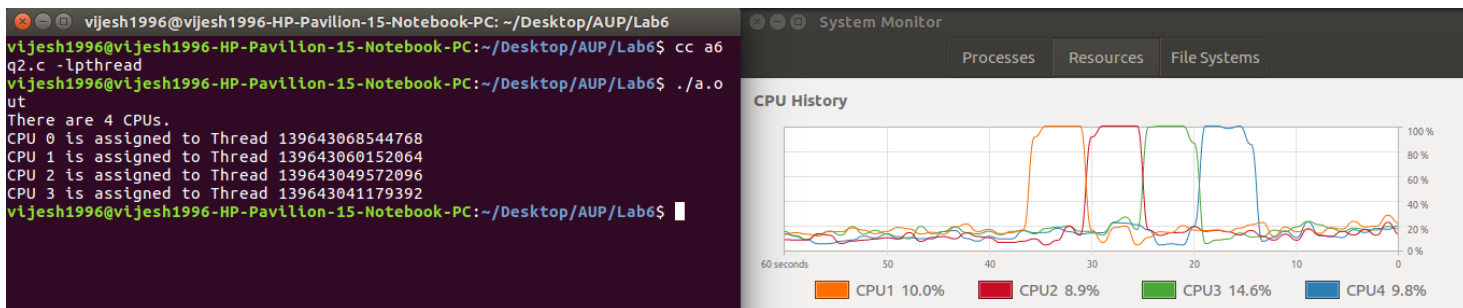
```
1 #define _GNU_SOURCE
2 #include<sched.h>
3 #include<pthread.h>
4 #include<stdio.h>
5 #include<stdlib.h>
6 #include<errno.h>
7 #include<unistd.h>
8 typedef struct params {                               /*parameter structure*/
9     pthread_mutex_t mutex;
10    pthread_cond_t done;
11    int cpu_id;
12 }params;
13 void* hello(void *arg){
14     pthread_mutex_lock(&(*(params*)(arg)).mutex);    /*mutext lock on arguements*/
15     int cpu = (*(params*)(arg)).cpu_id;
16     pthread_t thread = pthread_self();               /*get thread self_id*/
17     cpu_set_t cpuset;
18     CPU_ZERO(&cpuset);
19     CPU_SET(cpu, &cpuset);
20     int k = 2000000000;
21     int s = pthread_setaffinity_np(thread, sizeof(cpu_set_t), &cpuset);
22     if (s != 0)
23         printf("Error for CPU %d\n", cpu);
24     if(CPU_ISSET(cpu,&cpuset) != 0){
25         printf("CPU %d is assigned to Thread %lu\n",cpu,thread);
26     }
27     while(k){                                         // dummy loop to observe o/p
28         k--;                                         // using system monitor
29     }
30     pthread_mutex_unlock(&(*(params*)(arg)).mutex);
31     pthread_cond_signal(&(*(params*)(arg)).done);
32     pthread_exit(NULL);
33 }
34 int main(){
35     params pars;
36     pthread_mutex_init(&pars.mutex , NULL);
37     pthread_cond_init(&pars.done, NULL);
38     pthread_mutex_lock (&pars.mutex);
39     int j;
40     long int n_cpu = sysconf(_SC_NPROCESSORS_ONLN);
41     printf("There are %ld CPUs.\n",n_cpu);
42     pthread_t threads[n_cpu];
43     for (j = 0; j < n_cpu; j++){
44         pars.cpu_id = j;
45         pthread_create(&threads[j], NULL, hello, &pars);
46         pthread_cond_wait (&pars.done, &pars.mutex);
47     }
48     for(j = 0; j < n_cpu ; j++) {
49         pthread_join(threads[j], NULL);
50     }
51     pthread_mutex_destroy (&pars.mutex);
52     pthread_cond_destroy (&pars.done);
53     return 0;
54 }
```

## Output:

**\*Initial State of CPU cores on Computer.(Before program execution).**



**\*State of each CPU cores after creating threads.**



**Explanation:** From above observation we come to know that the each cpu has assigned one thread.

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Q3. Write a short program that creates 5 threads which print a thread "id" that is passed to thread function by pointer.

Program:

```
1 #include <pthread.h>
2 #include <stdio.h>
3 #include <stdlib.h>
4 typedef struct params {
5     pthread_mutex_t mutex;           // mutex lock for sync
6     pthread_cond_t done;             // done conditional variable
7     int id;                           // id variable which we want to print
8 }params;
9 void* printId(void* arg){
10     int id;
11     pthread_mutex_lock(&(*(params*)(arg)).mutex); /* Lock. */
12     id = (*(params*)(arg)).id;
13     printf("Hello from Thread %d\n", id);
14     pthread_mutex_unlock(&(*(params*)(arg)).mutex);
15     pthread_cond_signal(&(*(params*)(arg)).done);
16 }
17 }
18 int main() {
19     pthread_t threads[5];
20     params pars;
21     pthread_mutex_init (&pars.mutex , NULL);
22     pthread_cond_init (&pars.done, NULL);
23
24     pthread_mutex_lock (&pars.mutex); /* Obtain a lock on the parameter. */
25     int i;
26     for(i = 0; i < 5; i++) {
27         pars.id = i;
28         pthread_create(&threads[i], NULL, printId, &pars);
29         pthread_cond_wait (&pars.done, &pars.mutex); /* Give up the lock, wait till thread is 'done',
30                                                         then reacquire the lock. */
31     }
32     for(i = 0; i < 5; i++) {
33         pthread_join(threads[i], NULL);
34     }
35     /* Destroy all synchronization primitives. */
36     pthread_mutex_destroy (&pars.mutex);
37     pthread_cond_destroy (&pars.done);
38     return 0;
```

Output:

```
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC: ~/Desktop/AUP/Lab6
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~$ cd Desktop/AUP/Lab6
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop/AUP/Lab6$ cc a6q3.c -lpthread
vijesh1996@vijesh1996-HP-Pavilion-15-Notebook-PC:~/Desktop/AUP/Lab6$ ./a.out
Hello from Thread 0
Hello from Thread 1
Hello from Thread 2
Hello from Thread 3
Hello from Thread 4
```

