МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ НАЦІОНАЛЬНОМУ УНІВЕРСИТЕТІ "ЛЬВІВСЬКА ПОЛІТЕХНІКА"

Кафедра систем штучного інтелекту

Лабораторна робота №3

з дисципліни

«Операційні системи»

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Тема. Виконання задачі в декількох потоках в ОС Windows

Мета. Навчитись реалізовувати розпаралелювання алгоритмів за допомогою багатопоточності в ОС Windows з використанням функцій WinAPI.

Завдання.

1. Реалізувати заданий алгоритм в окремому потоці.

2. Виконати розпаралелювання заданого алгоритму на 2, 4, 8 потоків.

3. Реалізувати можливість зміни пріоритету певного потоку.

4. Результати виконання роботи відобразити у звіті.

Варіант 19:

19. Реалізувати пошук файлів за заданим розміром. Назви файлів повинні бути відсортовані в алфавітному порядку.

Код:

```
#include <Windows.h>

#include <thread>

#include <iostream>

#include <set>

#include <string>

#include <algorithm>

#include <iomanip>

#include <conio.h>

#include <stdio.h>

#include <locale>

#include <vector>

#include <tchar.h>

using namespace std;

WIN32_FIND_DATA FindFileData, FindFileData1;

DWORD nFileSizeLow;
```

```cpp
HANDLE hf, hf1;

FILETIME et, kt, ut;

SYSTEMTIME cm;

vector <string> files;

vector <long int> files_size;

vector <string> res;

int size0, per_process;

struct PARAMETERS

{ int from, to; };


void find_(int from) {

    cout << "Thread with ID " << this_thread::get_id() << " has started" << endl;

    int to = from + per_process - 1;

    for (int i = from; i <= to; i++) {

        bool is_file = false;

        for (int j = 0; j < files[i].length(); j++) {

            if (files[i][j] == '.') { is_file = true; }

        }

        if (files_size[i] == size0) {

            cout << files[i] << endl;

        }

        //Sleep(500);

    }

    cout << "Process with ID " << this_thread::get_id() << " has ended!" << endl;

    Sleep(500000);

}
```

```cpp
int main(int argv, char* argc[]) {
    SetConsoleCP(1251);
    SetConsoleOutputCP(1251);
    DWORD ID = 0;
    int cnt = 0, from, to;
    pair <int, int> p;
    static PARAMETERS par;
    hf = FindFirstFile("C:\\files\\*", &FindFileData);
    if (hf != INVALID_HANDLE_VALUE) {
        do {
            bool is_true = true;
            files.push_back(FindFileData.cFileName);
            files_size.push_back(FindFileData.nFileSizeLow);
            for (int j = 0; j < files[cnt].length(); j++) {
                if (files[cnt][j] == '.') { is_true = false; break; }
            }
            cnt++;
            if (is_true) {
                string s = "C:\\" + files[cnt - 1] + "\\*";
                const char* path = s.c_str();
                hf1 = FindFirstFile(path, &FindFileData1);
                if (hf != INVALID_HANDLE_VALUE) {
                    do {
                        files.push_back(FindFileData1.cFileName);
                        files_size.push_back(FindFileData1.nFileSizeLow);
                        cnt++;
                    } while (FindNextFile(hf1, &FindFileData1) != 0);
```

```cpp
            FindClose(hf1);

        }

      }

    } while (FindNextFile(hf, &FindFileData) != 0);

    FindClose(hf);

}

cout << "Number of files: " << endl << cnt << endl;

cout << "Enter size of file: " << endl;

cin >> size0;

cout << "Enter count of processes: " << endl;

int n;

cin >> n;

cout << endl;

per_process = cnt / n;

HANDLE* hThreads = new HANDLE[n];

for (int i = 0; i < n; i++) {

    from = (i * per_process);

    //cout << from << " ";

    p = make_pair(from, to);


    hThreads[i] = CreateThread(NULL, 0, (LPTHREAD_START_ROUTINE)find_,
(LPVOID)from, 0, &ID);

}

int choice;

_getch();

do {
```

```cpp
        cout << "Would you like to set the priority to one of the thread? " << endl
<< "1. Yes" << endl << "2. Exit" << endl;

        cin >> choice;

        if (choice == 1) {

            int thread;

            cout << "Input the number of thread: ";

            cin >> thread;

            cout << "1. Highest priority " << endl;

            cout << "2. Above normal priority " << endl;

            cout << "3. Normal priority " << endl;

            cout << "4. Below normal priority " << endl;

            cout << "5. Idle priority " << endl;

            int ch; cin >> ch;

            switch (ch) {

            case 1: {SetThreadPriority(hThreads[thread - 1],
THREAD_PRIORITY_HIGHEST); }

            case 2: {SetThreadPriority(hThreads[thread - 1],
THREAD_PRIORITY_ABOVE_NORMAL); }

            case 3: {SetThreadPriority(hThreads[thread - 1],
THREAD_PRIORITY_NORMAL); }

            case 4: {SetThreadPriority(hThreads[thread - 1],
THREAD_PRIORITY_BELOW_NORMAL); }

            case 5: {SetThreadPriority(hThreads[thread - 1],
THREAD_PRIORITY_IDLE); }

            }

        }

    } while (choice == 1);

    cout << "All threads ended!" << endl << endl;
```

```cpp
//for (int i = 0; i < n; i++) cout << "Thread " << this_thread::get_id()<< "
priority: " << GetThreadPriority(hThreads[i]) << endl;


    for (int i = 0; i < n; i++) {

        CloseHandle(hThreads[i]);

    }

    return 0;

}
```
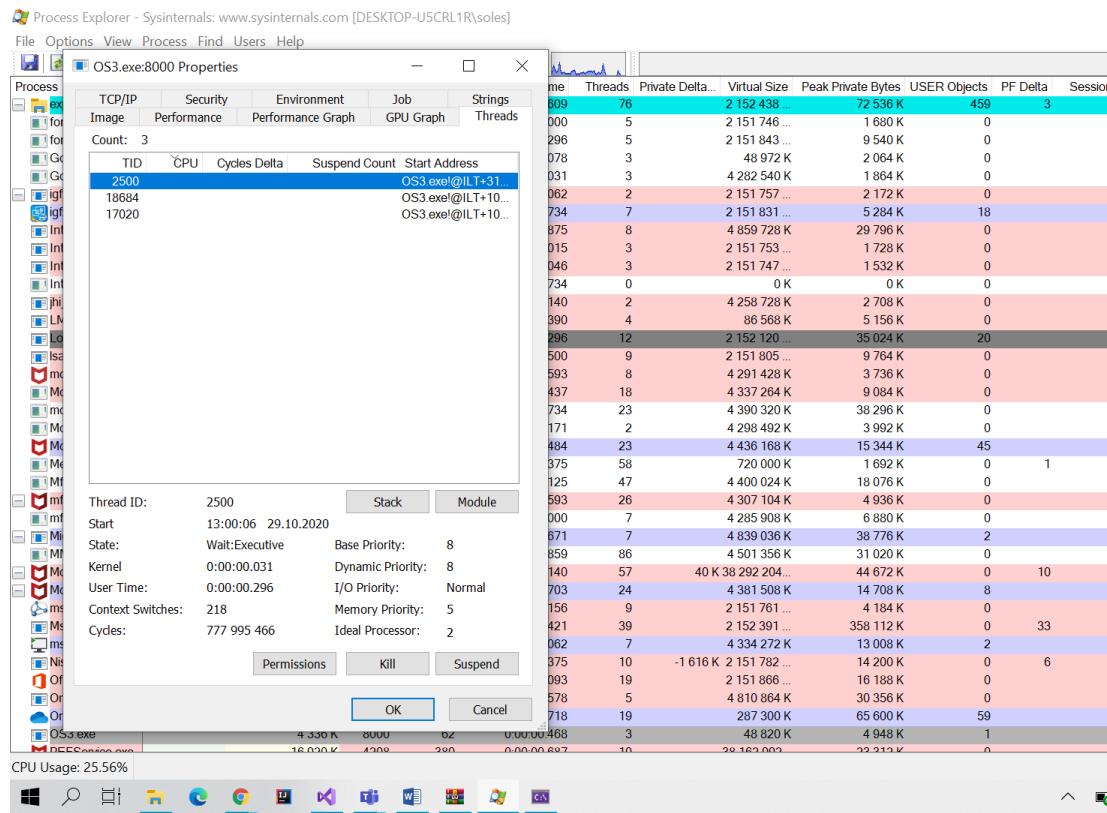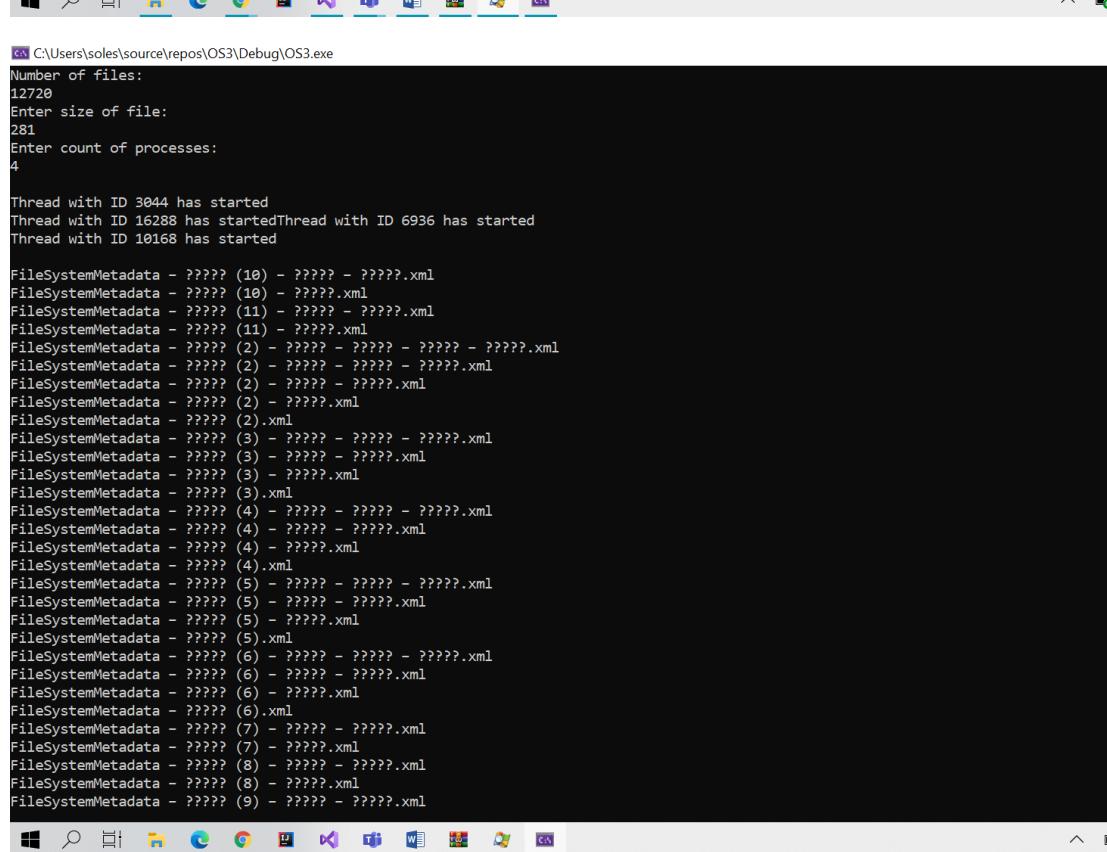


```
C:\Users\soles\source\repos\OS3\Debug\OS3.exe
Number of files:
12720
Enter size of file:
281
Enter count of processes:
2

Thread with ID 17020 has started
Thread with ID 18684 has started
FileSystemMetadata - ????? (10) - ????? - ?????.xml
FileSystemMetadata - ????? (10) - ?????.xml
FileSystemMetadata - ????? (11) - ????? - ?????.xml
FileSystemMetadata - ????? (11) - ?????.xml
FileSystemMetadata - ????? (2) - ????? - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (2) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (2) - ????? - ?????.xml
FileSystemMetadata - ????? (2) - ?????.xml
FileSystemMetadata - ????? (2).xml
FileSystemMetadata - ????? (3) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (3) - ????? - ?????.xml
FileSystemMetadata - ????? (3) - ?????.xml
FileSystemMetadata - ????? (3).xml
FileSystemMetadata - ????? (4) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (4) - ????? - ?????.xml
FileSystemMetadata - ????? (4) - ?????.xml
FileSystemMetadata - ????? (4).xml
FileSystemMetadata - ????? (5) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (5) - ????? - ?????.xml
FileSystemMetadata - ????? (5) - ?????.xml
FileSystemMetadata - ????? (5).xml
FileSystemMetadata - ????? (6) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (6) - ????? - ?????.xml
FileSystemMetadata - ????? (6) - ?????.xml
FileSystemMetadata - ????? (6).xml
FileSystemMetadata - ????? (7) - ????? - ?????.xml
FileSystemMetadata - ????? (7) - ?????.xml
FileSystemMetadata - ????? (8) - ????? - ?????.xml
FileSystemMetadata - ????? (8) - ?????.xml
FileSystemMetadata - ????? (9) - ????? - ?????.xml
FileSystemMetadata - ????? (9) - ?????.xml
FileSystemMetadata - ????? - ????? (2) - ????? - ????? - ?????.xml
```

File   Options   View   Process   Find   Users   Help

Process

OS3.exe:8000 Properties

| TCP/IP | Security | Environment | Job | Strings |
| Image | Performance | Performance Graph | GPU Graph | Threads |

Count: 3

TID	CPU	Cycles Delta	Suspend Count	Start Address
2500				OS3.exe!@ILT+31...
18684				OS3.exe!@ILT+10...
17020				OS3.exe!@ILT+10...

Thread ID: 2500
Start   13:00:06   29.10.2020
State: Wait:Executive   Base Priority: 8
Kernel   0:00:00.031   Dynamic Priority: 8
User Time: 0:00:00.296   I/O Priority: Normal
Context Switches: 218   Memory Priority: 5
Cycles: 777 995 466   Ideal Processor: 2

[Stack] [Module]

[Permissions]   [Kill]   [Suspend]

[OK]   [Cancel]

Threads	Private Delta...	Virtual Size	Peak Private Bytes	USER Objects	PF Delta	Session
76		2 152 438 ...	72 536 K	459	3	
5		2 151 746 ...	1 680 K	0		
5		2 151 843 ...	9 540 K	0		
3		48 972 K	2 064 K	0		
3		4 282 540 K	1 864 K	0		
2		2 151 757 ...	2 172 K	0		
7		2 151 831 ...	5 284 K	18		
8		4 859 728 K	29 796 K	0		
3		2 151 753 ...	1 728 K	0		
3		2 151 747 ...	1 532 K	0		
0		0 K	0 K	0		
2		4 258 728 K	2 708 K	0		
4		86 568 K	5 156 K	0		
12		2 152 120 ...	35 024 K	20		
9		2 151 805 ...	9 764 K	0		
8		4 291 428 K	3 736 K	0		
18		4 337 264 K	9 084 K	0		
23		4 390 320 K	38 296 K	0		
2		4 298 492 K	3 992 K	0		
23		4 436 168 K	15 344 K	45		
58		720 000 K	1 692 K	0	1	
47		4 400 024 K	18 076 K	0		
26		4 307 104 K	4 936 K	0		
7		4 285 908 K	6 880 K	0		
7		4 839 036 K	38 776 K	2		
86		4 501 356 K	31 020 K	0		
57	40 K 38 292 204...		44 672 K	0	10	
24		4 381 508 K	14 708 K	8		
9		2 151 761 ...	4 184 K	0		
39		2 152 391 ...	358 112 K	0	33	
7		4 334 272 K	13 008 K	2		
10	-1 616 K 2 151 782 ...		14 200 K	0	6	
19		2 151 866 ...	16 188 K	0		
5		4 810 864 K	30 356 K	0		
19		287 300 K	65 600 K	59		
3		48 820 K	4 948 K	1		

OS3.exe   4 336 K   8000   62   0:00:00.468
PFES....exe   16 020 K 4208   380   0:00:00.687   10   38 162 002   23 312 K   0

CPU Usage: 25.56%

```
Number of files:
12720
Enter size of file:
281
Enter count of processes:
4

Thread with ID 3044 has started
Thread with ID 16288 has startedThread with ID 6936 has started
Thread with ID 10168 has started

FileSystemMetadata - ????? (10) - ????? - ?????.xml
FileSystemMetadata - ????? (10) - ?????.xml
FileSystemMetadata - ????? (11) - ????? - ?????.xml
FileSystemMetadata - ????? (11) - ?????.xml
FileSystemMetadata - ????? (2) - ????? - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (2) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (2) - ????? - ?????.xml
FileSystemMetadata - ????? (2) - ?????.xml
FileSystemMetadata - ????? (2).xml
FileSystemMetadata - ????? (3) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (3) - ????? - ?????.xml
FileSystemMetadata - ????? (3) - ?????.xml
FileSystemMetadata - ????? (3).xml
FileSystemMetadata - ????? (4) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (4) - ????? - ?????.xml
FileSystemMetadata - ????? (4) - ?????.xml
FileSystemMetadata - ????? (4).xml
FileSystemMetadata - ????? (5) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (5) - ????? - ?????.xml
FileSystemMetadata - ????? (5) - ?????.xml
FileSystemMetadata - ????? (5).xml
FileSystemMetadata - ????? (6) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? (6) - ????? - ?????.xml
FileSystemMetadata - ????? (6) - ?????.xml
FileSystemMetadata - ????? (6).xml
FileSystemMetadata - ????? (7) - ????? - ?????.xml
FileSystemMetadata - ????? (7) - ?????.xml
FileSystemMetadata - ????? (8) - ????? - ?????.xml
FileSystemMetadata - ????? (8) - ?????.xml
FileSystemMetadata - ????? (9) - ????? - ?????.xml
```
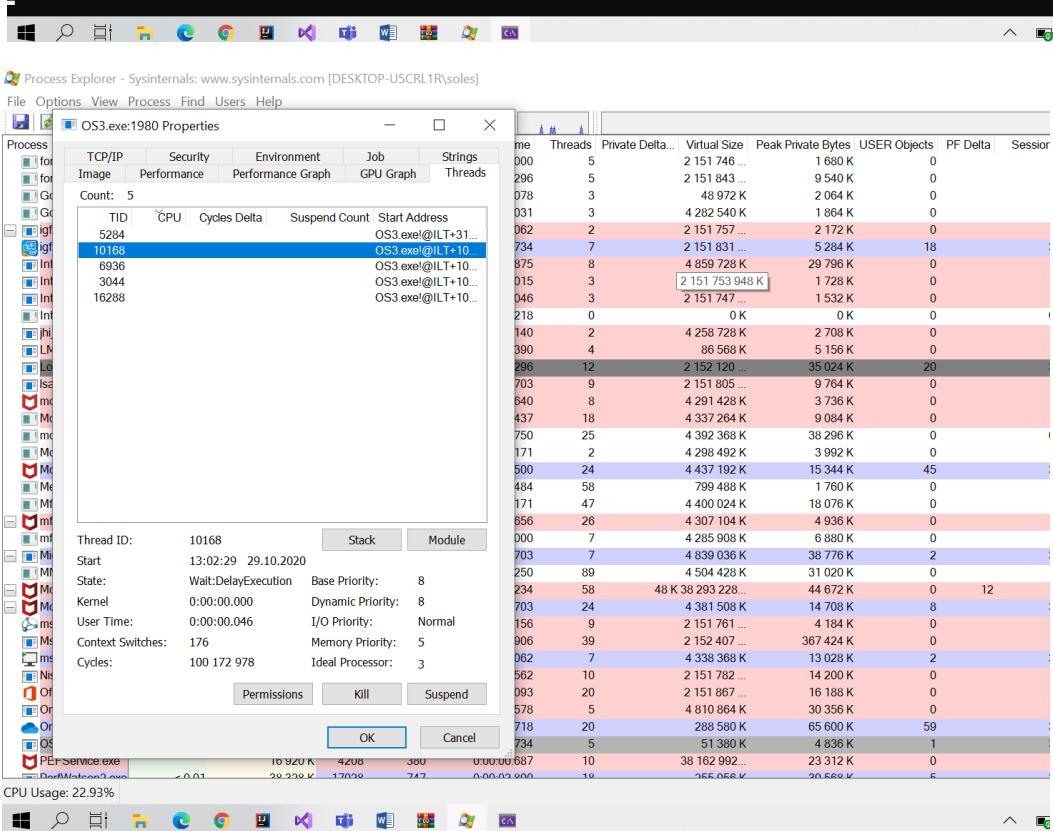
C:\Users\soles\source\repos\OS3\Debug\OS3.exe

```
FileSystemMetadata - ????? (8) - ?????.xml
FileSystemMetadata - ????? (9) - ????? - ?????.xml
FileSystemMetadata - ????? (9) - ?????.xml
FileSystemMetadata - ????? - ????? (2) - ????? - ????? - ?????.xml
FileSystemMetadata - ????? - ????? (2) - ????? - ?????.xml
FileSystemMetadata - ????? - ????? (2) - ????? - ?????.xml
FileSystemMetadata - ????? - ????? (2).xml
FileSystemMetadata - ????? - ????? (3) - ????? - ?????.xml
FileSystemMetadata - ????? - ????? (3) - ????? - ?????.xml
FileSystemMetadata - ????? - ????? (3).xml
FileSystemMetadata - ????? - ????? (4) - ????? - ?????.xml
FileSystemMetadata - ????? - ????? (4) - ????? - ?????.xml
FileSystemMetadata - ????? - ????? (4).xml
FileSystemMetadata - ????? - ????? (5) - ????? - ?????.xml
FileSystemMetadata - ????? - ????? (5) - ????? - ?????.xml
FileSystemMetadata - ????? - ????? (5).xml
FileSystemMetadata - ????? - ????? (6) - ?????.xml
FileSystemMetadata - ????? - ????? (7) - ?????.xml
FileSystemMetadata - ????? - ????? - ????? (2) - ????? - ?????.xml
FileSystemMetadata - ????? - ????? - ????? (2) - ?????.xml
FileSystemMetadata - ????? - ????? - ????? (2).xml
FileSystemMetadata - ????? - ????? - ????? (3) - ?????.xml
Process with ID 3044 has ended!
FileSystemMetadata - ????? - ????? - ????? (3).xml
Process with ID 6936 has ended!
FileSystemMetadata - ????? - ????? - ????? (4) - ?????.xml
Process with ID 16288 has ended!
FileSystemMetadata - ????? - ????? - ????? (4).xml
FileSystemMetadata - ????? - ????? - ????? - ????? (2) - ?????.xml
FileSystemMetadata - ????? - ????? - ????? - ????? (2).xml
FileSystemMetadata - ????? - ????? - ????? - ????? (3).xml
FileSystemMetadata - ????? - ????? - ????? - ????? - ????? (2).xml
FileSystemMetadata - ????? - ????? - ????? - ????? - ????? - ?????.xml
FileSystemMetadata - ????? - ????? - ????? - ????? - ?????.xml
FileSystemMetadata - ????? - ????? - ????? - ?????.xml
FileSystemMetadata - ????? - ????? - ?????.xml
FileSystemMetadata - ????? - ?????.xml
FileSystemMetadata - ?????.xml
FileSystemMetadata.xml
Process with ID 10168 has ended!
```
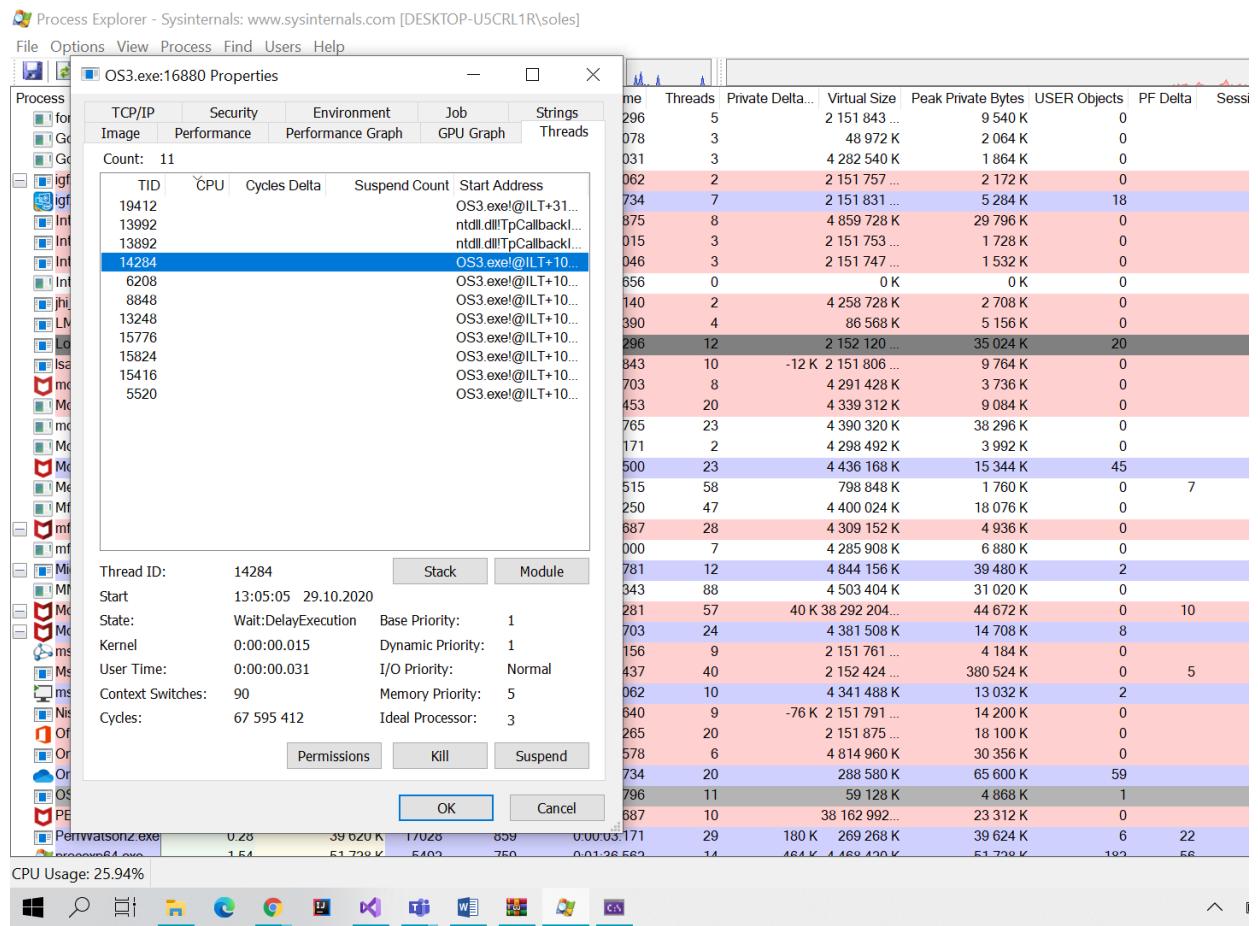
```
Number of files:
12720
Enter size of file:
93
Enter count of processes:
8

Thread with ID 9864 has started
Thread with ID Thread with ID 13340 has started
Thread with ID 6192 has started
Thread with ID 11288 has started
Thread with ID 2580 has started
Thread with ID 2168 has startedThread with ID 8048 has started

13888 has started
rolloutfile - ????? (10) - ????? - ????? - ?????.tv13
rolloutfile - ????? (10) - ????? - ?????.tv13
rolloutfile - ????? (10) - ?????.tv13
rolloutfile - ????? (11) - ????? - ????? - ?????.tv13
rolloutfile - ????? (11) - ????? - ?????.tv13
rolloutfile - ????? (11) - ?????.tv13
rolloutfile - ????? (12) - ????? - ????? - ?????.tv13
rolloutfile - ????? (12) - ????? - ?????.tv13
rolloutfile - ????? (12) - ?????.tv13
rolloutfile - ????? (13) - ????? - ????? - ?????.tv13
rolloutfile - ????? (13) - ????? - ?????.tv13
rolloutfile - ????? (13) - ?????.tv13
rolloutfile - ????? (14) - ????? - ????? - ?????.tv13
rolloutfile - ????? (14) - ????? - ?????.tv13
rolloutfile - ????? (14) - ?????.tv13
rolloutfile - ????? (15) - ????? - ????? - ?????.tv13
rolloutfile - ????? (15) - ????? - ?????.tv13
rolloutfile - ????? (15) - ?????.tv13
Process with ID 13340 has ended!
Process with ID 8048 has ended!
rolloutfile - ????? (16) - ????? - ????? - ?????.tv13
rolloutfile - ????? (16) - ????? - ?????.tv13
Process with ID 2168 has ended!
Process with ID 11288 has ended!
Process with ID 9864 has ended!
Process with ID 13888 has ended!rolloutfile - ????? (16) - ?????.tv13
```

```
rolloutfile - ????? - ????? - ????? (3) - ?????.tv13
rolloutfile - ????? - ????? - ????? (3).tv13
rolloutfile - ????? - ????? - ????? (4) - ????? - ?????.tv13
rolloutfile - ????? - ????? - ????? (4) - ?????.tv13
rolloutfile - ????? - ????? - ????? (4).tv13
rolloutfile - ????? - ????? - ????? (5) - ????? - ?????.tv13
rolloutfile - ????? - ????? - ????? (5) - ?????.tv13
rolloutfile - ????? - ????? - ????? (5).tv13
rolloutfile - ????? - ????? - ????? (6) - ?????.tv13
rolloutfile - ????? - ????? - ????? (7) - ?????.tv13
rolloutfile - ????? - ????? - ????? - ????? (2) - ????? - ?????.tv13
rolloutfile - ????? - ????? - ????? - ????? (2) - ?????.tv13
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rolloutfile - ????? - ????? - ????? - ????? (4) - ?????.tv13
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rolloutfile - ????? - ????? - ????? - ????? - ????? - ????? (2).tv13
rolloutfile - ????? - ????? - ????? - ????? - ????? - ????? - ?????.tv13
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rolloutfile - ????? - ????? - ????? - ????? - ?????.tv13
rolloutfile - ????? - ????? - ????? - ?????.tv13
rolloutfile - ????? - ????? - ?????.tv13
rolloutfile - ????? - ?????.tv13
rolloutfile - ?????.tv13
rolloutfile.tv13
Process with ID 6192 has ended!
Would you like to set the priority to one of the thread?
1. Yes
2. Exit
1
Input the number of thread: 1
1. Highest priority
2. Above normal priority
3. Normal priority
4. Below normal priority
5. Idle priority
5
```

Висновок: В ході роботи над цією лабораторною, я навчилась створювати потоки, розпалалелювати завдання та міняти пріорітет одного з потоків.