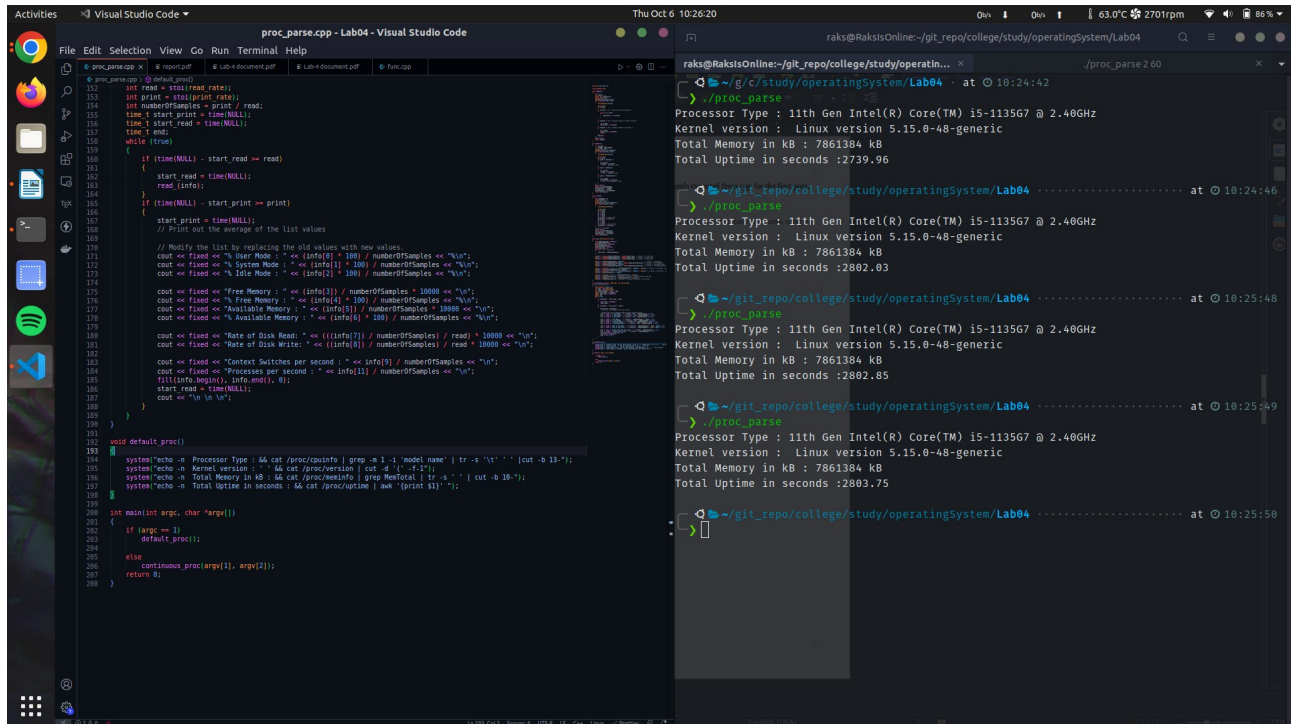


The following program `proc_parse` uses bash commands executed from `cpp` for the first part, and in the next part, it uses file handling .

1st Version:

If no parameters are passed while execution, the program executes certain bash commands using the `system(<args>)` function.

Here's the output as well as the code snippet to display the same.



The screenshot shows the Visual Studio Code editor with the file `proc_parse.cpp` open. The code is a C++ program that uses the `system()` function to execute various system commands and parse their output. The terminal window on the right shows the output of the program, which includes system information such as processor type, kernel version, total memory, and uptime.

```
151 int read = stoi(read_rate);
152 int print = stoi(print_rate);
153 int numberOfSamples = print / read;
154 time_t start_read = time(NULL);
155 time_t start_print = time(NULL);
156 time_t end;
157 while (true)
158 {
159     if (time(NULL) - start_read == read)
160     {
161         start_read = time(NULL);
162         read_info();
163     }
164     if (time(NULL) - start_print == print)
165     {
166         start_print = time(NULL);
167         // Print out the average of the list values
168         // Modify the list by replacing the old values with new values.
169         cout << fixed << "User Mode : " << (info[0] * 100) / numberOfSamples << "%\n";
170         cout << fixed << "System Mode : " << (info[1] * 100) / numberOfSamples << "%\n";
171         cout << fixed << "Idle Mode : " << (info[2] * 100) / numberOfSamples << "%\n";
172         cout << fixed << "Free Memory : " << (info[3]) / numberOfSamples * 10000 << "%\n";
173         cout << fixed << "Free Memory : " << (info[4] * 100) / numberOfSamples << "%\n";
174         cout << fixed << "Available Memory : " << (info[5]) / numberOfSamples * 10000 << "%\n";
175         cout << fixed << "Available Memory : " << (info[6] * 100) / numberOfSamples << "%\n";
176         cout << fixed << "Rate of Disk Read : " << ((info[7]) / numberOfSamples) / read * 10000 << "%\n";
177         cout << fixed << "Rate of Disk Write : " << ((info[8]) / numberOfSamples) / read * 10000 << "%\n";
178         cout << fixed << "Context Switches per second : " << (info[9] / numberOfSamples << "%\n";
179         cout << fixed << "Processes per second : " << (info[10] / numberOfSamples << "%\n";
180         start_read = time(NULL);
181         fill(info.begin(), info.end(), 0);
182         cout << " \n in %s\n";
183     }
184 }
185
186 void default_proc()
187 {
188     system("echo -n Processor Type : && cat /proc/cpuinfo | grep -m 1 -i 'model name' | tr -s '\t' | cut -b 13.");
189     system("echo -n Kernel version : " && cat /proc/version | cut -d ' ' -f 1.");
190     system("echo -n Total Memory in kB : && cat /proc/meminfo | grep MemTotal | tr -s ' ' | cut -b 10.");
191     system("echo -n Total Uptime in seconds : && cat /proc/uptime | awk '{print $1}'");
192 }
193
194 int main(int argc, char *argv[])
195 {
196     if (argc == 1)
197         default_proc();
198     else
199         continuous_proc(argv[1], argv[2]);
200     return 0;
201 }
```

Terminal Output:

```
raks@RakSisOnline:~/git_repo/college/study/operatingSystem/Lab04$ ./proc_parse
Processor Type : 11th Gen Intel(R) Core(TM) i5-1135G7 @ 2.40GHz
Kernel version : Linux version 5.15.0-48-generic
Total Memory in kB : 7861384 kB
Total Uptime in seconds : 2739.96

raks@RakSisOnline:~/git_repo/college/study/operatingSystem/Lab04$ ./proc_parse
Processor Type : 11th Gen Intel(R) Core(TM) i5-1135G7 @ 2.40GHz
Kernel version : Linux version 5.15.0-48-generic
Total Memory in kB : 7861384 kB
Total Uptime in seconds : 2802.03

raks@RakSisOnline:~/git_repo/college/study/operatingSystem/Lab04$ ./proc_parse
Processor Type : 11th Gen Intel(R) Core(TM) i5-1135G7 @ 2.40GHz
Kernel version : Linux version 5.15.0-48-generic
Total Memory in kB : 7861384 kB
Total Uptime in seconds : 2802.85

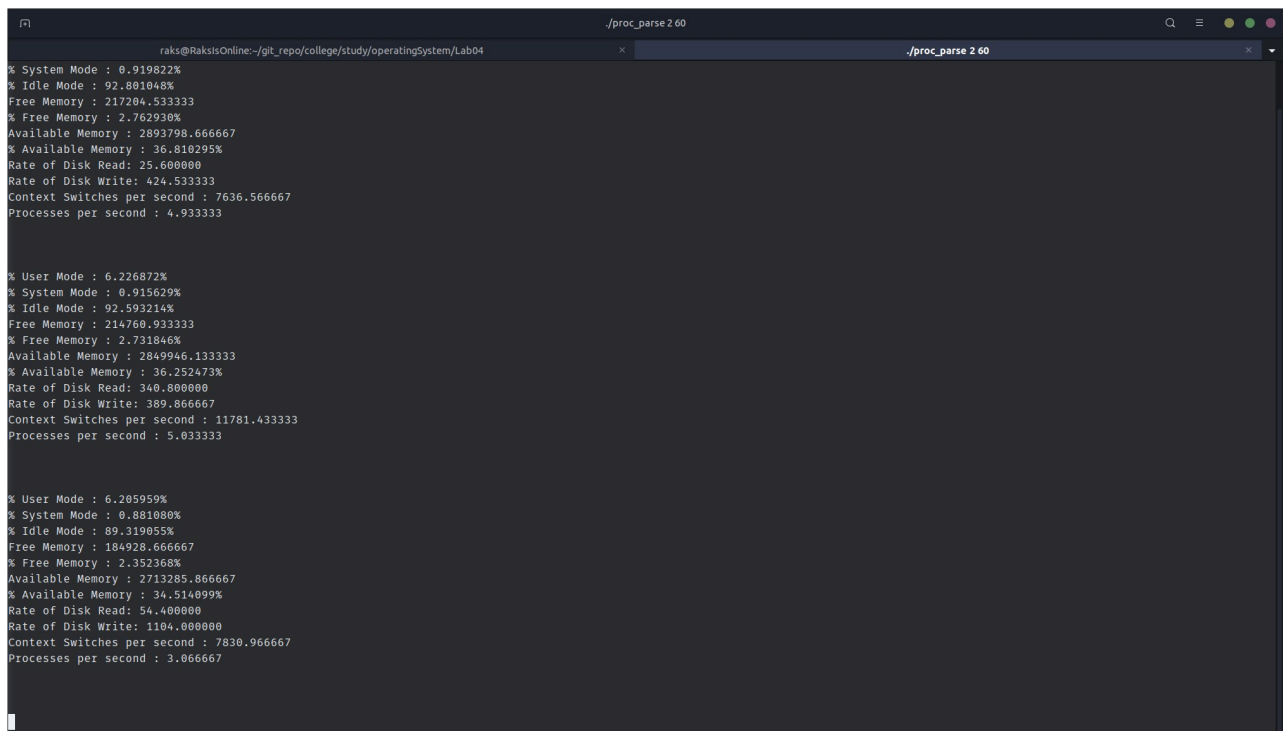
raks@RakSisOnline:~/git_repo/college/study/operatingSystem/Lab04$ ./proc_parse
Processor Type : 11th Gen Intel(R) Core(TM) i5-1135G7 @ 2.40GHz
Kernel version : Linux version 5.15.0-48-generic
Total Memory in kB : 7861384 kB
Total Uptime in seconds : 2803.75

raks@RakSisOnline:~/git_repo/college/study/operatingSystem/Lab04$
```

The bash commands used are – *cat*, *awk*, *tr*, and *grep*.

2nd Version:

As far as the second version of the code is concerned, the output are as follows :



```
./proc_parse 2 60
raks@RaksisOnline:~/git_repo/college/study/operatingSystem/Lab04
% System Mode : 0.919822%
% Idle Mode : 92.881848%
Free Memory : 217204.533333
% Free Memory : 2.762930%
Available Memory : 2893798.666667
% Available Memory : 36.810295%
Rate of Disk Read: 25.600000
Rate of Disk Write: 424.533333
Context Switches per second : 7636.566667
Processes per second : 4.933333

% User Mode : 6.226872%
% System Mode : 0.915629%
% Idle Mode : 92.593214%
Free Memory : 214760.933333
% Free Memory : 2.731846%
Available Memory : 2849946.133333
% Available Memory : 36.252473%
Rate of Disk Read: 340.800000
Rate of Disk Write: 389.866667
Context Switches per second : 11781.433333
Processes per second : 5.033333

% User Mode : 6.205959%
% System Mode : 0.881080%
% Idle Mode : 89.319055%
Free Memory : 184928.666667
% Free Memory : 2.352368%
Available Memory : 2713285.866667
% Available Memory : 34.514099%
Rate of Disk Read: 54.400000
Rate of Disk Write: 1104.000000
Context Switches per second : 7830.966667
Processes per second : 3.066667
```

For this part of the code, command line arguments have been used to determine the print and read rate. After that, various */proc* files are read via *ifstream()* to get values of the above. Percentages are calculated, rate is calculated through the read rate and number of samples, etc. Since few values were provided with regards to boot-time, previous values were stored to calculate number of new processes/context switches produced.

Time was calculated using *time()* function to keep a track of the read rate and print rate. Number of Samples is basically the ratio of print rate and read rate.

The code is as follows :

```
proc_parse.cpp - Lab04 - Visual Studio Code
File Edit Selection View Go Run Terminal Help
proc_parse.cpp X report.pdf Lab-4 document.pdf Lab-4 document.pdf Func.cpp
proc_parse.cpp > CPUInfo()
1 #include <bits/stdc++.h>
2
3 using namespace std;
4
5 long *CPUInfo()
6 {
7     int k = 0;
8     int nthLine = 1;
9     static long cpuInfo[12];
10    string line, word;
11    ifstream finfo("/proc/stat");
12    while (getline(finfo, line))
13    {
14        istringstream ss(line);
15
16        string word;
17        ss >> word;
18
19        if (nthLine == 1) // Contains all CPU information !!
20        {
21            while (ss >> word)
22            {
23                cpuInfo[k++] = stoi(word);
24            }
25        }
26
27        if (nthLine == 11) // Contains number of context switches !!
28        {
29            ss >> word;
30            cpuInfo[10] = stoi(word);
31        }
32        if (nthLine == 13) // Contains number of processes !!
33        {
34            ss >> word;
35            cpuInfo[11] = stoi(word);
36            break;
37        }
38        nthLine++;
39    }
40    finfo.close();
41    return cpuInfo;
42 }
43
44 int *memInfo()
45 {
46     int totalMem = 0,
47         freeMem, availableMem;
48     string line, word;
49     ifstream finfo("/proc/meminfo");
50     while (getline(finfo, line))
51     {
52         istringstream ss(line);
53
54         string word;
55         ss >> word;
56         if (word == "MemTotal:")
57         {
58             ss >> word;
59             totalMem = stoi(word);
60             // cout << totalMem << endl;
61         }
62         if (word == "MemFree:")
63         {
64             ss >> word;
65             freeMem = stoi(word);
66             // cout << freeMem << endl;
67         }
68         if (word == "MemAvailable:")
69         {
70             ss >> word;
71             availableMem = stoi(word);
72             // cout << availableMem << endl;
73         }
74     }
75     finfo.close();
76     static int information[3];
77     information[0] = totalMem;
78     information[1] = freeMem;
79     information[2] = availableMem;
80     return information;
81 }
82
83 long *diskIO()
84 {
85     long totalRead = 0;
86     long totalWrite = 0;
87     string word, line;
88     ifstream finfo("/proc/diskstats");
89     while (getline(finfo, line))
90     {
91         istringstream ss(line);
92         string word;
93         ss >> word;
94         if (word == "read")
95         {
96             ss >> word;
97             totalRead += stoi(word);
98         }
99         if (word == "write")
100        {
101            ss >> word;
102            totalWrite += stoi(word);
103        }
104    }
105    return {totalRead, totalWrite};
106 }
```

```
proc_parse.cpp - Lab04 - Visual Studio Code
File Edit Selection View Go Run Terminal Help
proc_parse.cpp X report.pdf Lab-4 document.pdf Lab-4 document.pdf Func.cpp
proc_parse.cpp > CPUInfo()
43
44 int *memInfo()
45 {
46     int totalMem = 0,
47         freeMem, availableMem;
48     string line, word;
49     ifstream finfo("/proc/meminfo");
50     while (getline(finfo, line))
51     {
52         istringstream ss(line);
53
54         string word;
55         ss >> word;
56         if (word == "MemTotal:")
57         {
58             ss >> word;
59             totalMem = stoi(word);
60             // cout << totalMem << endl;
61         }
62         if (word == "MemFree:")
63         {
64             ss >> word;
65             freeMem = stoi(word);
66             // cout << freeMem << endl;
67         }
68         if (word == "MemAvailable:")
69         {
70             ss >> word;
71             availableMem = stoi(word);
72             // cout << availableMem << endl;
73         }
74     }
75     finfo.close();
76     static int information[3];
77     information[0] = totalMem;
78     information[1] = freeMem;
79     information[2] = availableMem;
80     return information;
81 }
82
83 long *diskIO()
84 {
85     long totalRead = 0;
86     long totalWrite = 0;
87     string word, line;
88     ifstream finfo("/proc/diskstats");
89     while (getline(finfo, line))
90     {
91         istringstream ss(line);
92         string word;
93         ss >> word;
94         if (word == "read")
95         {
96             ss >> word;
97             totalRead += stoi(word);
98         }
99         if (word == "write")
100        {
101            ss >> word;
102            totalWrite += stoi(word);
103        }
104    }
105    return {totalRead, totalWrite};
106 }
```

```
proc_parse.cpp - Lab04 - Visual Studio Code
File Edit Selection View Go Run Terminal Help
proc_parse.cpp x report.pdf Lab-4 document.pdf Lab-4 document.pdf Func.cpp
proc_parse.cpp > CPUInfo()
82
83 long *diskIO()
84 {
85     long totalRead = 0;
86     long totalWrite = 0;
87     string word, line;
88     ifstream finfo("/proc/diskstats");
89     while (getline(finfo, line))
90     {
91         istringstream ss(line);
92
93         string word;
94         ss >> word;
95         ss >> word;
96         ss >> word;
97         ss >> word;
98         ss >> word; // Sector read
99         totalRead += stoi(word);
100         ss >> word;
101         ss >> word;
102         ss >> word;
103         ss >> word; // Sector Write
104         totalWrite += stoi(word);
105     }
106     // cout << totalRead;
107     finfo.close();
108     static long information[2];
109     information[0] = totalRead;
110     information[1] = totalWrite;
111     return information;
112 }
113
114 void read_(vector<double> &info)
115 {
116     long *CPUinformation = CPUInfo();
117     int *memoryInformation;
118     memoryInformation = memInfo();
119     long *diskInformation;
120     diskInformation = diskIO();
121     long total_time = 0;
122     for (int i = 0; i < 10; i++)
123     {
124         total_time += CPUinformation[i];
125     }
126
127     info[0] += ((double)CPUinformation[0] / (double)total_time); // info[0] -> % user time
128     info[1] += ((double)CPUinformation[2] / (double)total_time); // info[1] -> %system time
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proc_parse.cpp - Lab04 - Visual Studio Code
File Edit Selection View Go Run Terminal Help
proc_parse.cpp x report.pdf Lab-4 document.pdf Lab-4 document.pdf func.cpp
proc_parse.cpp > read(vector<double>&)
143     info[i] = (CPUInformation[i]); // info[iw] -> # previous processes in the system
144 }
145
146 void continuous_proc(char *read_rate, char *print_rate)
147 // void continuous_proc()
148 {
149     vector<double> info(15, 0);
150     int read = stoi(read_rate);
151     int print = stoi(print_rate);
152     int numberOfSamples = print / read;
153     time_t start_print = time(NULL);
154     time_t start_read = time(NULL);
155     while (true)
156     {
157         if (time(NULL) - start_read >= read)
158         {
159             start_read = time(NULL);
160             read_info();
161         }
162         if (time(NULL) - start_print >= print)
163         {
164             start_print = time(NULL);
165             // Print out the average of the list values
166
167             // Modify the list by replacing the old values with new values.
168             cout << fixed << "User Mode : " << (info[0] * 100) / numberOfSamples << "\n";
169             cout << fixed << "System Mode : " << (info[1] * 100) / numberOfSamples << "\n";
170             cout << fixed << "Idle Mode : " << (info[2] * 100) / numberOfSamples << "\n";
171
172             cout << fixed << "Free Memory : " << (info[3]) / numberOfSamples * 10000 << "\n";
173             cout << fixed << "Free Memory : " << (info[4] * 100) / numberOfSamples << "\n";
174             cout << fixed << "Available Memory : " << (info[5]) / numberOfSamples * 10000 << "\n";
175             cout << fixed << "Available Memory : " << (info[6] * 100) / numberOfSamples << "\n";
176
177             cout << fixed << "Rate of Disk Read : " << ((info[7]) / numberOfSamples) / read * 10000 << "\n";
178             cout << fixed << "Rate of Disk Write : " << ((info[8]) / numberOfSamples) / read * 10000 << "\n";
179
180             cout << fixed << "Context Switches per second : " << info[9] / numberOfSamples << "\n";
181             cout << fixed << "Processes per second : " << info[11] / numberOfSamples << "\n";
182             fill(info.begin(), info.end(), 0);
183             start_read = time(NULL);
184             cout << "\n\n";
185         }
186     }
187 }
188
189 void default_proc()
190 {
191 }
192
193 int main(int argc, char *argv[])
194 {
195     if (argc == 1)
196         default_proc();
197     else
198         continuous_proc(argv[1], argv[2]);
199     return 0;
200 }
```

```
proc_parse.cpp - Lab04 - Visual Studio Code
File Edit Selection View Go Run Terminal Help
proc_parse.cpp x report.pdf Lab-4 document.pdf Lab-4 document.pdf func.cpp
proc_parse.cpp > read(vector<double>&)
163     read_info();
164 }
165
166 if (time(NULL) - start_print >= print)
167 {
168     start_print = time(NULL);
169     // Print out the average of the list values
170
171     // Modify the list by replacing the old values with new values.
172     cout << fixed << "User Mode : " << (info[0] * 100) / numberOfSamples << "\n";
173     cout << fixed << "System Mode : " << (info[1] * 100) / numberOfSamples << "\n";
174     cout << fixed << "Idle Mode : " << (info[2] * 100) / numberOfSamples << "\n";
175
176     cout << fixed << "Free Memory : " << (info[3]) / numberOfSamples * 10000 << "\n";
177     cout << fixed << "Free Memory : " << (info[4] * 100) / numberOfSamples << "\n";
178     cout << fixed << "Available Memory : " << (info[5]) / numberOfSamples * 10000 << "\n";
179     cout << fixed << "Available Memory : " << (info[6] * 100) / numberOfSamples << "\n";
180
181     cout << fixed << "Rate of Disk Read : " << ((info[7]) / numberOfSamples) / read * 10000 << "\n";
182     cout << fixed << "Rate of Disk Write : " << ((info[8]) / numberOfSamples) / read * 10000 << "\n";
183
184     cout << fixed << "Context Switches per second : " << info[9] / numberOfSamples << "\n";
185     cout << fixed << "Processes per second : " << info[11] / numberOfSamples << "\n";
186     fill(info.begin(), info.end(), 0);
187     start_read = time(NULL);
188     cout << "\n\n";
189 }
190
191 void default_proc()
192 {
193     system("echo -n Processor Type : && cat /proc/cpuinfo | grep -m 1 -i 'model name' | tr -s '\t' ' ' | cut -b 13-");
194     system("echo -n Kernel version : " && cat /proc/version | cut -d '(' -f 1-");
195     system("echo -n Total Memory in kB : && cat /proc/meminfo | grep MemTotal | tr -s ' ' | cut -b 10-");
196     system("echo -n Total Uptime in seconds : && cat /proc/uptime | awk '{print $1}'");
197 }
198
199 int main(int argc, char *argv[])
200 {
201     if (argc == 1)
202         default_proc();
203     else
204         continuous_proc(argv[1], argv[2]);
205     return 0;
206 }
```