CAPSTONE PROJECT- 2 CUSTOM SHELL IMPLEMENTATION

Objective: Build a simple shell in C++ that can execute commands, manage processes, and handle redirection and piping

CODE

```
#include <iostream>
#include <sstream>
#include <vector>
#include <string>
#include <cstdlib>
#include <direct.h>   // _chdir
#include <windows.h>  // HANDLE, PROCESS_INFORMATION

using namespace std;
struct Job {
   int id;
   string command;
   PROCESS_INFORMATION procInfo;
};
vector<Job> jobList;
int jobCounter = 1;

// Split user input into tokens
vector<string> parseInput(const string &input) {
   stringstream ss(input);
   string token;
   vector<string> args;
   while (ss >> token) args.push_back(token);
   return args;
}

// Launch a background job
void launchBackgroundJob(const string &command) {
   string cmd = "cmd /c " + command;
   STARTUPINFOA si = { sizeof(si) };
   PROCESS_INFORMATION pi;
   BOOL success = CreateProcessA(
      nullptr, (LPSTR)cmd.c_str(),
      nullptr, nullptr, FALSE,
      CREATE_NEW_CONSOLE, nullptr, nullptr,
      &si, &pi
   );

   if (success) {
      Job job;
      job.id = jobCounter++;
```

```
        job.command = command;
        job.procInfo = pi;
        jobList.push_back(job);
        cout << "[Job " << job.id << "] Started: " << command << endl;
    } else {
        cerr << "Failed to start background process." << endl;
    }
}

// Show all background jobs
void listJobs() {
    cout << "\nActive Background Jobs:\n";
    bool any = false;
    for (auto &job : jobList) {
        DWORD exitCode;
        GetExitCodeProcess(job.procInfo.hProcess, &exitCode);
        if (exitCode == STILL_ACTIVE) {
            any = true;
            cout << "  [" << job.id << "] " << job.command << " (Running)" << endl;
        }
    }
    if (!any) cout << "  No active background jobs.\n";
}

// Bring job to foreground (wait for it)
void bringToForeground(int jobId) {
    for (auto &job : jobList) {
        if (job.id == jobId) {
            cout << "Bringing job [" << job.id << "] to foreground...\n";
            WaitForSingleObject(job.procInfo.hProcess, INFINITE);
            CloseHandle(job.procInfo.hProcess);
            CloseHandle(job.procInfo.hThread);
            cout << "Job [" << job.id << "] completed.\n";
            return;
        }
    }
    cout << "No such job ID.\n";
}

int main() {
    string input;

    cout << "--------------------------------------------\n";
    cout << "   Custom Shell (Windows) – Job Control Ready\n";
    cout << "   Created by: Adyasha Muni\n";
    cout << "   Type 'exit' to quit\n";
    cout << "--------------------------------------------\n";
```

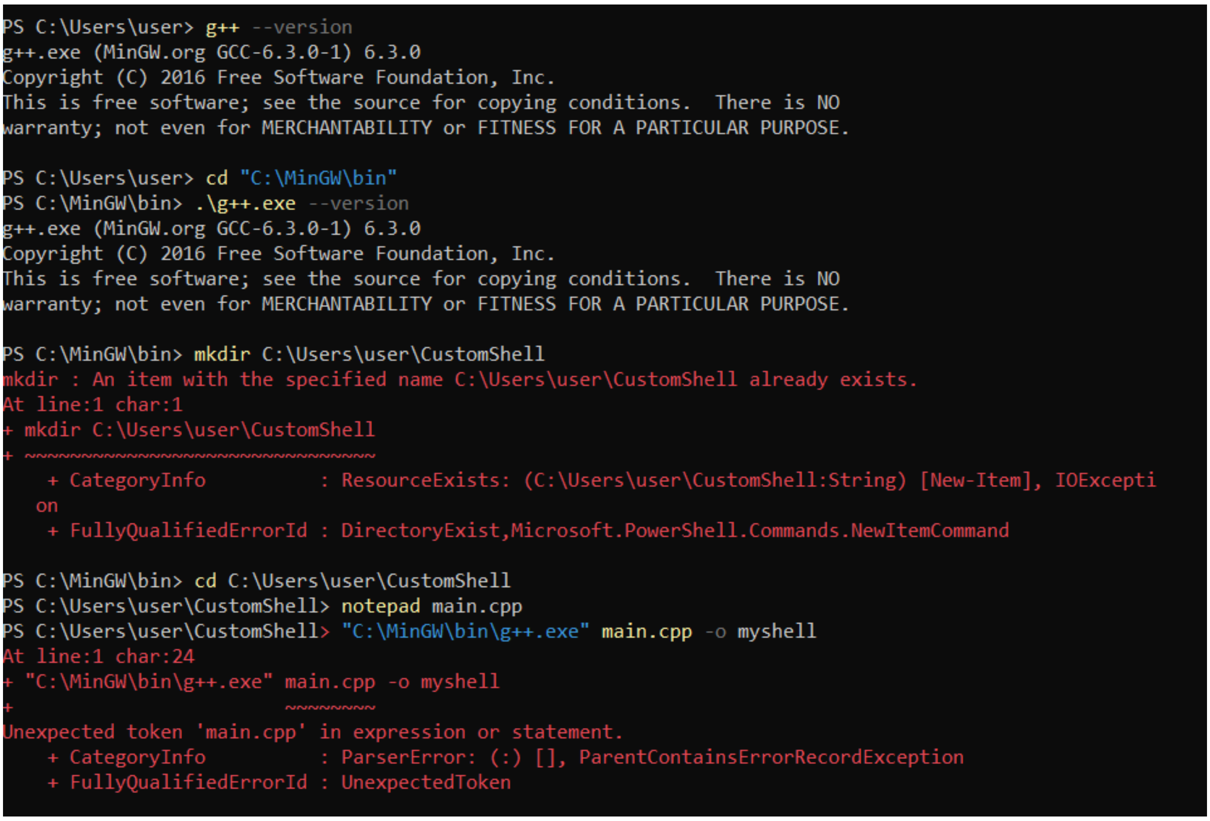
```cpp
    while (true) {
        cout << "MyShell> ";
        getline(cin, input);

        if (input.empty()) continue;
        if (input == "exit") break;

        // Built-in: cd
        if (input.rfind("cd", 0) == 0) {
            string path = input.substr(3);
            if (path.empty()) path = getenv("USERPROFILE");
            if (_chdir(path.c_str()) != 0)
                perror("cd failed");
            continue;
        }
        // Built-in: jobs
        if (input == "jobs") {
            listJobs();
            continue;
        }
        // Built-in: fg <id>
        if (input.rfind("fg", 0) == 0) {
            vector<string> parts = parseInput(input);
            if (parts.size() < 2) {
                cout << "Usage: fg <job_id>\n";
                continue;
            }
            bringToForeground(stoi(parts[1]));
            continue;
        }
        // Background job (&)
        if (input.back() == '&') {
            input.pop_back();
            launchBackgroundJob(input);
            continue;
        }
        // Normal command
        int ret = system(input.c_str());
        if (ret == -1)
            cout << "Command failed!\n";
    }

  cout << "Exiting MyShell...\n";
    return 0;
}
```

1



```
PS C:\Users\user> g++ --version
g++.exe (MinGW.org GCC-6.3.0-1) 6.3.0
Copyright (C) 2016 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

PS C:\Users\user> cd "C:\MinGW\bin"
PS C:\MinGW\bin> .\g++.exe --version
g++.exe (MinGW.org GCC-6.3.0-1) 6.3.0
Copyright (C) 2016 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

PS C:\MinGW\bin> mkdir C:\Users\user\CustomShell
mkdir : An item with the specified name C:\Users\user\CustomShell already exists.
At line:1 char:1
+ mkdir C:\Users\user\CustomShell
+ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
    + CategoryInfo          : ResourceExists: (C:\Users\user\CustomShell:String) [New-Item], IOExcepti
   on
    + FullyQualifiedErrorId : DirectoryExist,Microsoft.PowerShell.Commands.NewItemCommand

PS C:\MinGW\bin> cd C:\Users\user\CustomShell
PS C:\Users\user\CustomShell> notepad main.cpp
PS C:\Users\user\CustomShell> "C:\MinGW\bin\g++.exe" main.cpp -o myshell
At line:1 char:24
+ "C:\MinGW\bin\g++.exe" main.cpp -o myshell
+                        ~~~~~~~~
Unexpected token 'main.cpp' in expression or statement.
    + CategoryInfo          : ParserError: (:) [], ParentContainsErrorRecordException
    + FullyQualifiedErrorId : UnexpectedToken
```

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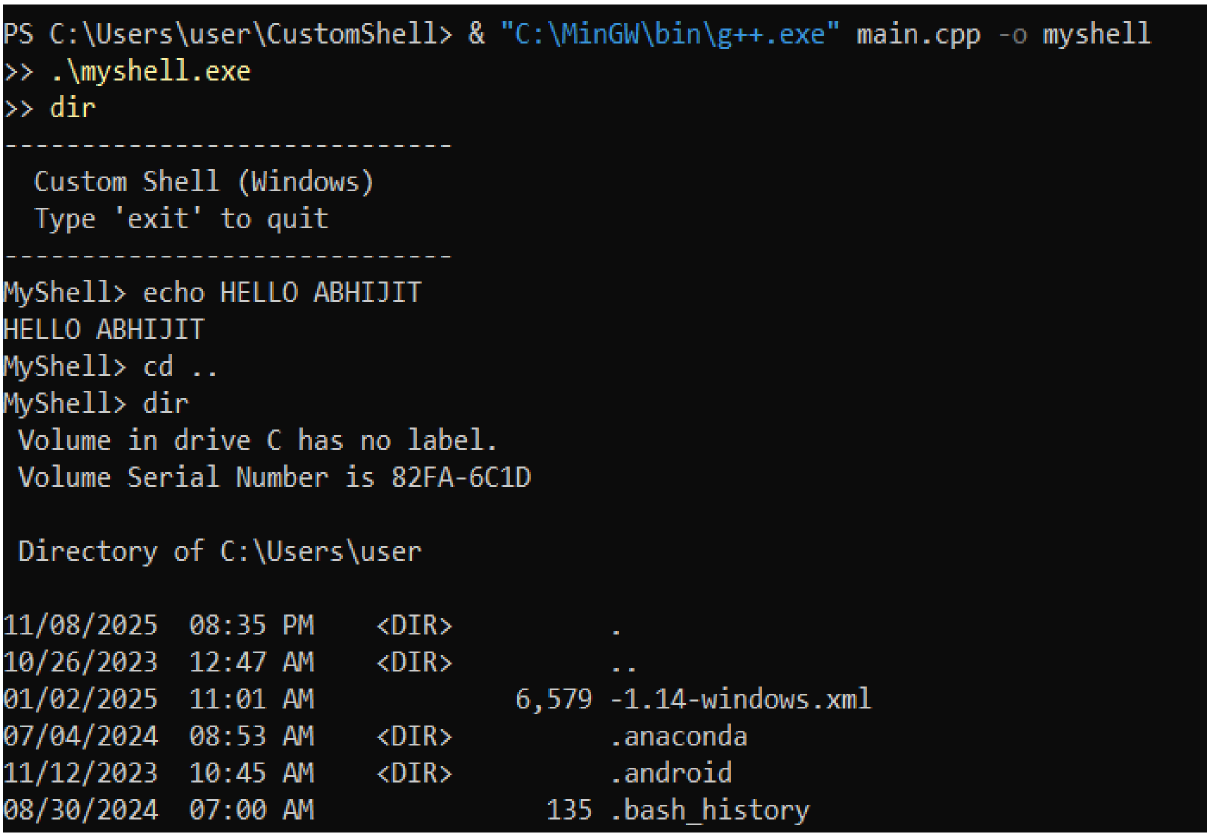

```
PS C:\Users\user\CustomShell> & "C:\MinGW\bin\g++.exe" main.cpp -o myshell
>> .\myshell.exe
>> dir
-----------------------------
  Custom Shell (Windows)
  Type 'exit' to quit
-----------------------------
MyShell> echo HELLO ABHIJIT
HELLO ABHIJIT
MyShell> cd ..
MyShell> dir
 Volume in drive C has no label.
 Volume Serial Number is 82FA-6C1D

 Directory of C:\Users\user

11/08/2025  08:35 PM    <DIR>          .
10/26/2023  12:47 AM    <DIR>          ..
01/02/2025  11:01 AM             6,579 -1.14-windows.xml
07/04/2024  08:53 AM    <DIR>          .anaconda
11/12/2023  10:45 AM    <DIR>          .android
08/30/2024  07:00 AM               135 .bash_history
```

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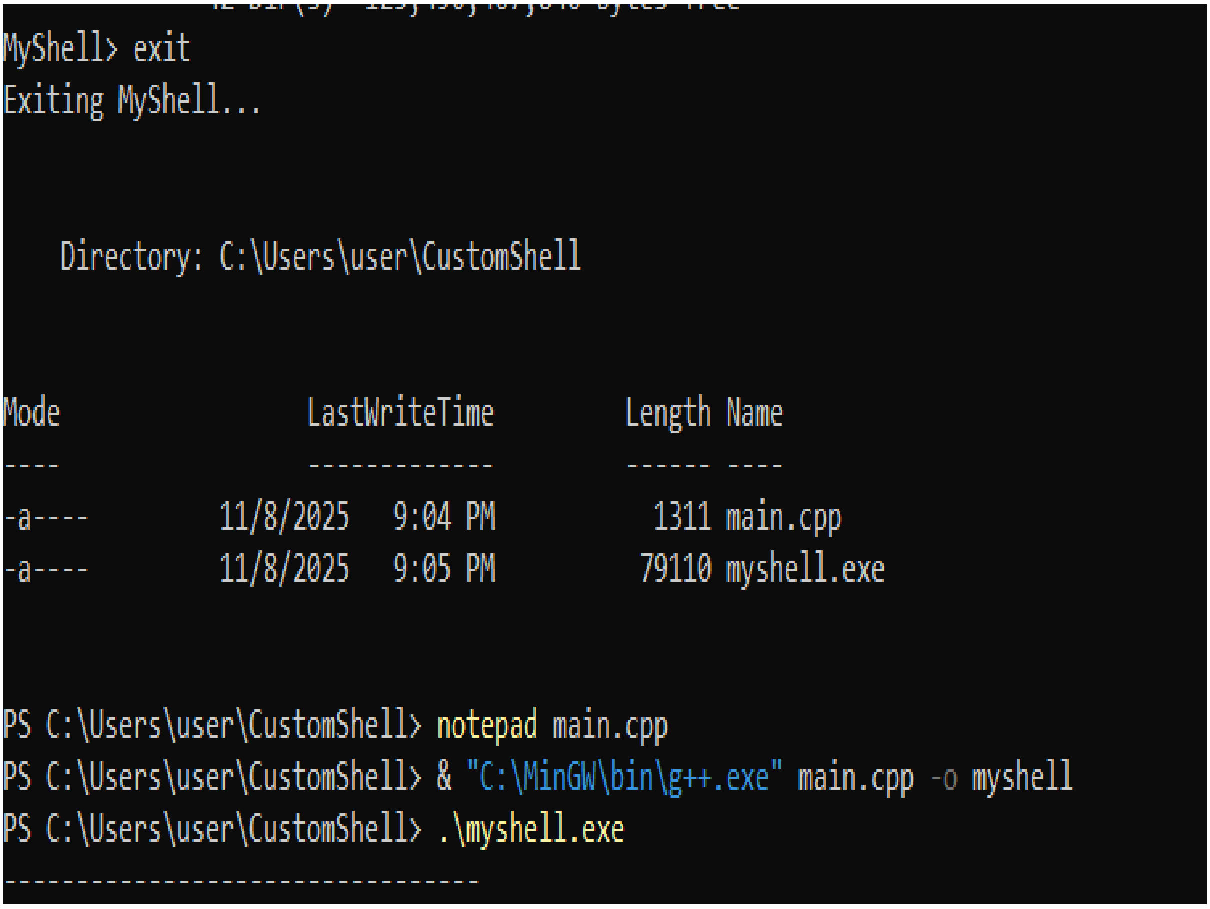
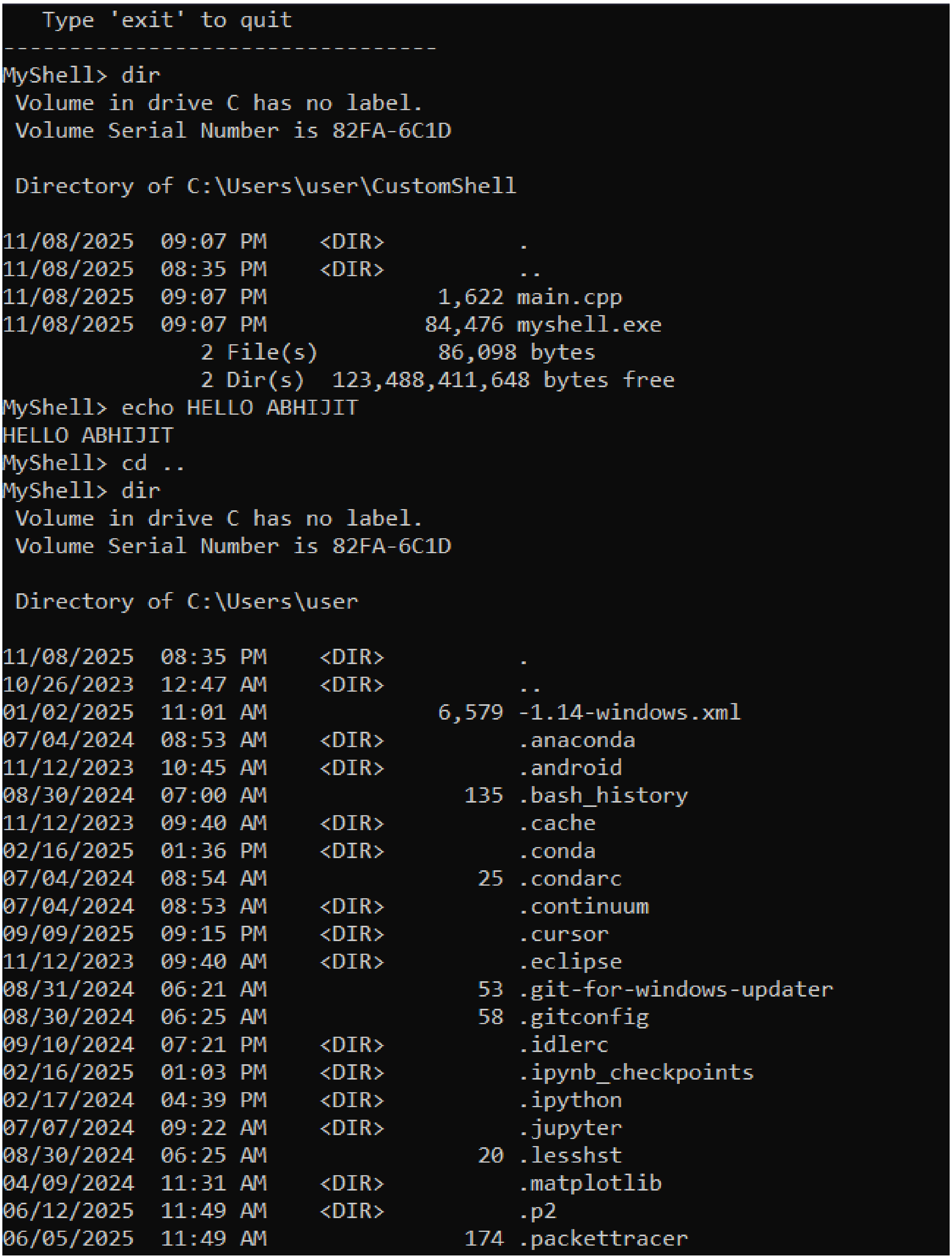
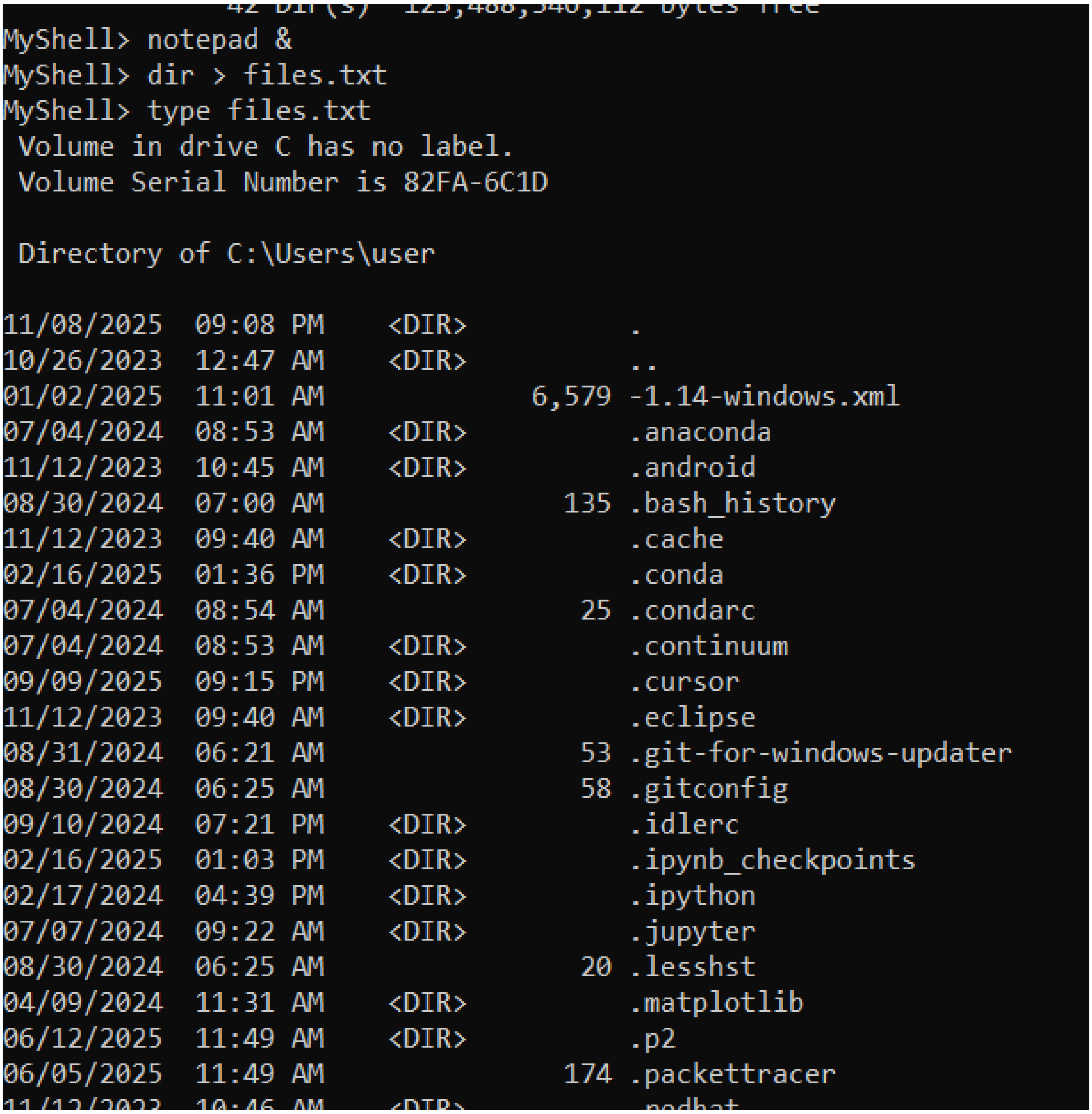


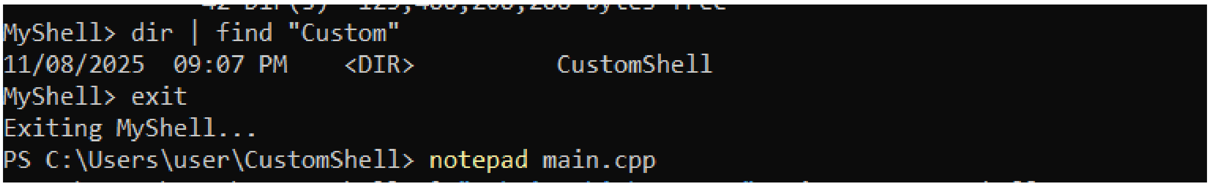
```
              12 Dir(s)  123,456,[illegible] bytes free
MyShell> exit
Exiting MyShell...


    Directory: C:\Users\user\CustomShell


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
-a----         11/8/2025   9:04 PM           1311 main.cpp
-a----         11/8/2025   9:05 PM          79110 myshell.exe


PS C:\Users\user\CustomShell> notepad main.cpp
PS C:\Users\user\CustomShell> & "C:\MinGW\bin\g++.exe" main.cpp -o myshell
PS C:\Users\user\CustomShell> .\myshell.exe
---------------------------------
```



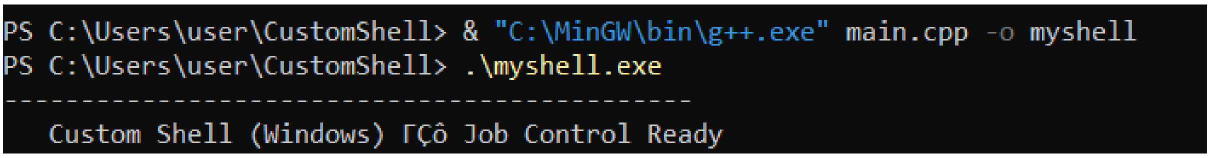
```
   Type 'exit' to quit
---------------------------------
MyShell> dir
 Volume in drive C has no label.
 Volume Serial Number is 82FA-6C1D

 Directory of C:\Users\user\CustomShell

11/08/2025  09:07 PM    <DIR>          .
11/08/2025  08:35 PM    <DIR>          ..
11/08/2025  09:07 PM             1,622 main.cpp
11/08/2025  09:07 PM            84,476 myshell.exe
               2 File(s)         86,098 bytes
               2 Dir(s)  123,488,411,648 bytes free
MyShell> echo HELLO ABHIJIT
HELLO ABHIJIT
MyShell> cd ..
MyShell> dir
 Volume in drive C has no label.
 Volume Serial Number is 82FA-6C1D

 Directory of C:\Users\user

11/08/2025  08:35 PM    <DIR>          .
10/26/2023  12:47 AM    <DIR>          ..
01/02/2025  11:01 AM             6,579 -1.14-windows.xml
07/04/2024  08:53 AM    <DIR>          .anaconda
11/12/2023  10:45 AM    <DIR>          .android
08/30/2024  07:00 AM               135 .bash_history
11/12/2023  09:40 AM    <DIR>          .cache
02/16/2025  01:36 PM    <DIR>          .conda
07/04/2024  08:54 AM                25 .condarc
07/04/2024  08:53 AM    <DIR>          .continuum
09/09/2025  09:15 PM    <DIR>          .cursor
11/12/2023  09:40 AM    <DIR>          .eclipse
08/31/2024  06:21 AM                53 .git-for-windows-updater
08/30/2024  06:25 AM                58 .gitconfig
09/10/2024  07:21 PM    <DIR>          .idlerc
02/16/2025  01:03 PM    <DIR>          .ipynb_checkpoints
02/17/2024  04:39 PM    <DIR>          .ipython
07/07/2024  09:22 AM    <DIR>          .jupyter
08/30/2024  06:25 AM                20 .lesshst
04/09/2024  11:31 AM    <DIR>          .matplotlib
06/12/2025  11:49 AM    <DIR>          .p2
06/05/2025  11:49 AM               174 .packettracer
```
]



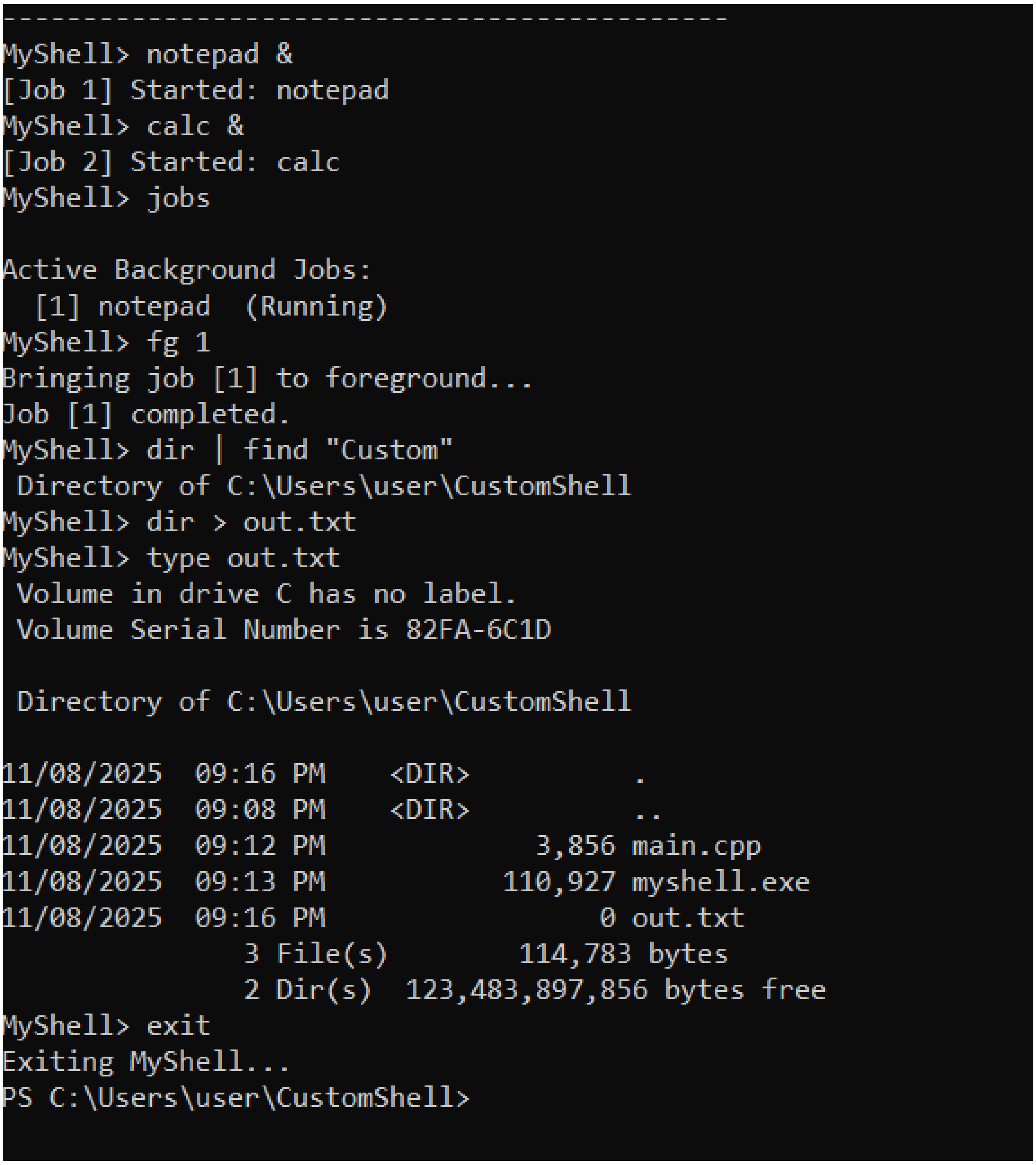
```
              42 Dir(s)  123,488,340,112 bytes free
MyShell> notepad &
MyShell> dir > files.txt
MyShell> type files.txt
 Volume in drive C has no label.
 Volume Serial Number is 82FA-6C1D

 Directory of C:\Users\user

11/08/2025  09:08 PM    <DIR>          .
10/26/2023  12:47 AM    <DIR>          ..
01/02/2025  11:01 AM             6,579 -1.14-windows.xml
07/04/2024  08:53 AM    <DIR>          .anaconda
11/12/2023  10:45 AM    <DIR>          .android
08/30/2024  07:00 AM               135 .bash_history
11/12/2023  09:40 AM    <DIR>          .cache
02/16/2025  01:36 PM    <DIR>          .conda
07/04/2024  08:54 AM                25 .condarc
07/04/2024  08:53 AM    <DIR>          .continuum
09/09/2025  09:15 PM    <DIR>          .cursor
11/12/2023  09:40 AM    <DIR>          .eclipse
08/31/2024  06:21 AM                53 .git-for-windows-updater
08/30/2024  06:25 AM                58 .gitconfig
09/10/2024  07:21 PM    <DIR>          .idlerc
02/16/2025  01:03 PM    <DIR>          .ipynb_checkpoints
02/17/2024  04:39 PM    <DIR>          .ipython
07/07/2024  09:22 AM    <DIR>          .jupyter
08/30/2024  06:25 AM                20 .lesshst
04/09/2024  11:31 AM    <DIR>          .matplotlib
06/12/2025  11:49 AM    <DIR>          .p2
06/05/2025  11:49 AM               174 .packettracer
11/12/2023  10:46 AM    <DIR>          .redhat
```



```
MyShell> dir | find "Custom"
11/08/2025  09:07 PM    <DIR>          CustomShell
MyShell> exit
Exiting MyShell...
PS C:\Users\user\CustomShell> notepad main.cpp
```



```
PS C:\Users\user\CustomShell> & "C:\MinGW\bin\g++.exe" main.cpp -o myshell
PS C:\Users\user\CustomShell> .\myshell.exe
---------------------------------------------
   Custom Shell (Windows) ΓÇô Job Control Ready
```



```
---------------------------------------------
MyShell> notepad &
[Job 1] Started: notepad
MyShell> calc &
[Job 2] Started: calc
MyShell> jobs

Active Background Jobs:
  [1] notepad  (Running)
MyShell> fg 1
Bringing job [1] to foreground...
Job [1] completed.
MyShell> dir | find "Custom"
 Directory of C:\Users\user\CustomShell
MyShell> dir > out.txt
MyShell> type out.txt
 Volume in drive C has no label.
 Volume Serial Number is 82FA-6C1D

 Directory of C:\Users\user\CustomShell

11/08/2025  09:16 PM    <DIR>          .
11/08/2025  09:08 PM    <DIR>          ..
11/08/2025  09:12 PM             3,856 main.cpp
11/08/2025  09:13 PM           110,927 myshell.exe
11/08/2025  09:16 PM                 0 out.txt
               3 File(s)        114,783 bytes
               2 Dir(s)  123,483,897,856 bytes free
MyShell> exit
Exiting MyShell...
PS C:\Users\user\CustomShell>
```