TheReverser-Find_password

https://crackmes.one/crackme/5e9f4e8033c5d476117463a9

Crackme writeup by @H0l3Bl4ck https://twitter.com/H0l3Bl4ck

crackmes.one user b1h0 https://crackmes.one/user/b1h0

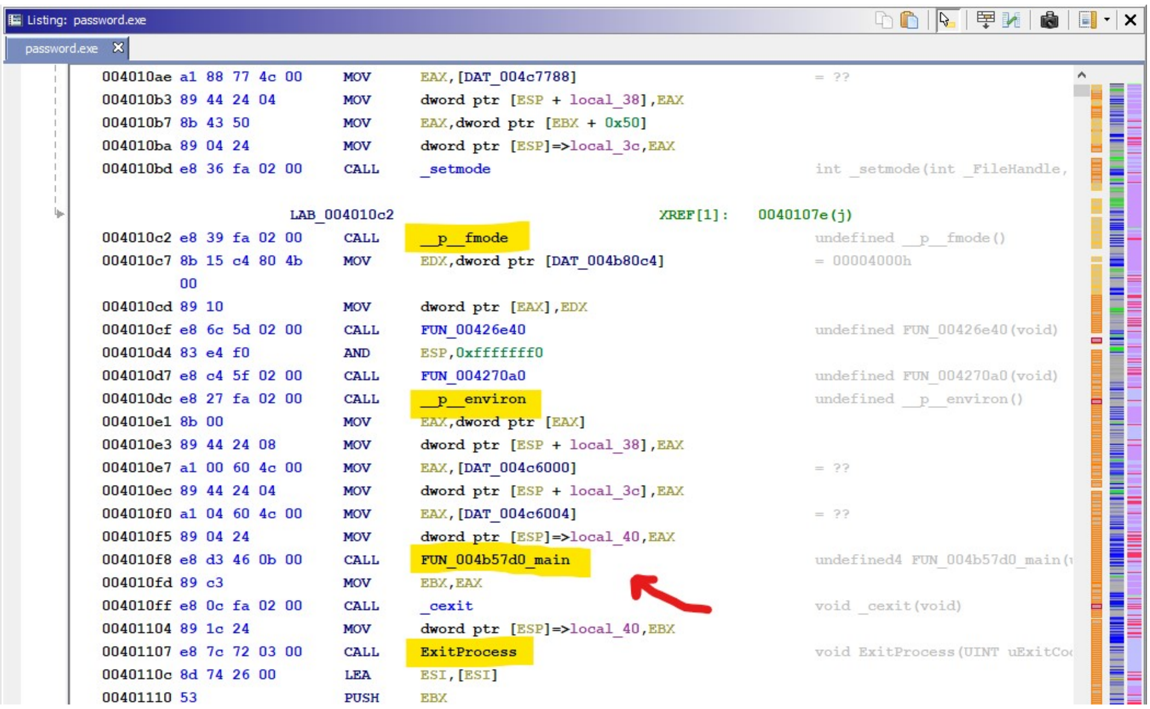
Date: 05/may/2020

You can download **TheReverser-Find_password** from this link.

Ghidra's static analysis

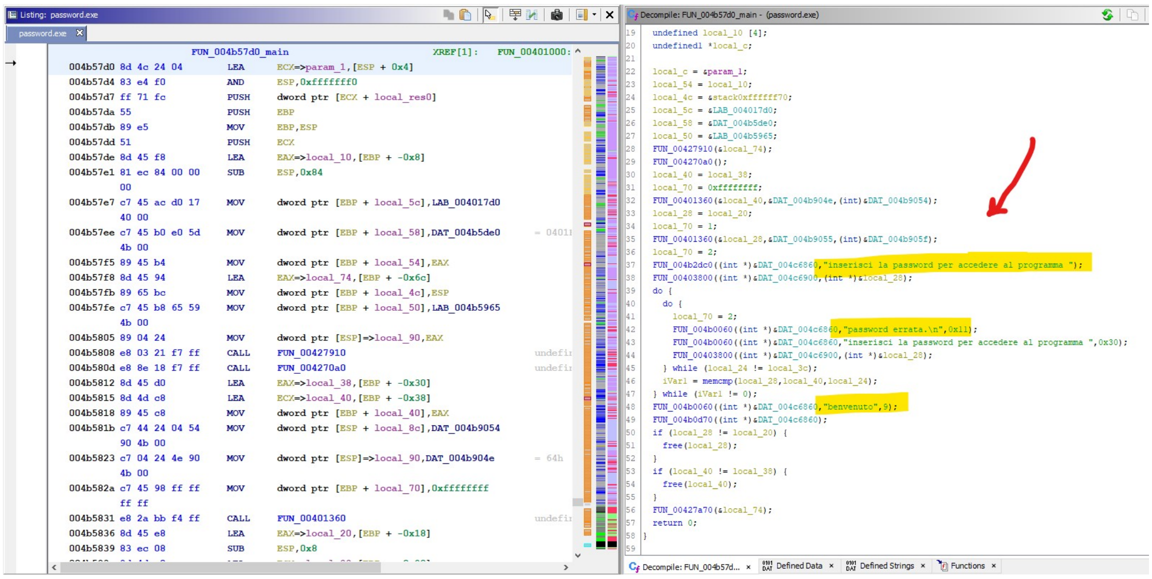
We have a **Windows executable**, which has no reference to the **main()** function. We look for the entry point and we follow the different calls where we find a part of the code where it makes calls to the CRT mode and then to the environment variables, and then below there is a call to the exit to the system.

It is in this area, before the exit to the system, where the **main()** function of the program is located, so we rename it as the first starting point.



```
004010ae a1 88 77 4c 00     MOV     EAX,[DAT_004c7788]                        = ??
004010b3 89 44 24 04        MOV     dword ptr [ESP + local_38],EAX
004010b7 8b 43 50           MOV     EAX,dword ptr [EBX + 0x50]
004010ba 89 04 24           MOV     dword ptr [ESP]=>local_3c,EAX
004010bd e8 36 fa 02 00     CALL    _setmode                                  int _setmode(int _FileHandle,

                      LAB_004010c2                          XREF[1]:    0040107e(j)
004010c2 e8 39 fa 02 00     CALL    __p__fmode                                undefined __p__fmode()
004010c7 8b 15 c4 80 4b     MOV     EDX,dword ptr [DAT_004b80c4]              = 00004000h
         00
004010cd 89 10              MOV     dword ptr [EAX],EDX
004010cf e8 6c 5d 02 00     CALL    FUN_00426e40                              undefined FUN_00426e40(void)
004010d4 83 e4 f0           AND     ESP,0xfffffff0
004010d7 e8 c4 5f 02 00     CALL    FUN_004270a0                              undefined FUN_004270a0(void)
004010dc e8 27 fa 02 00     CALL    __p__environ                              undefined __p__environ()
004010e1 8b 00              MOV     EAX,dword ptr [EAX]
004010e3 89 44 24 08        MOV     dword ptr [ESP + local_38],EAX
004010e7 a1 00 60 4c 00     MOV     EAX,[DAT_004c6000]                        = ??
004010ec 89 44 24 04        MOV     dword ptr [ESP + local_3c],EAX
004010f0 a1 04 60 4c 00     MOV     EAX,[DAT_004c6004]                        = ??
004010f5 89 04 24           MOV     dword ptr [ESP]=>local_40,EAX
004010f8 e8 d3 46 0b 00     CALL    FUN_004b57d0_main                         undefined4 FUN_004b57d0_main(
004010fd 89 c3              MOV     EBX,EAX
004010ff e8 0c fa 02 00     CALL    _cexit                                    void _cexit(void)
00401104 89 1c 24           MOV     dword ptr [ESP]=>local_40,EBX
00401107 e8 7c 72 03 00     CALL    ExitProcess                               void ExitProcess(UINT uExitCo
0040110c 8d 74 26 00        LEA     ESI,[ESI]
00401110 53                 PUSH    EBX
```

Entering already inside the **main()** we can quickly identify, and helping ourselves with the decompiler, the area where it shows the messages and asks us for the password. We already have specific points to look at and some variables to rename.

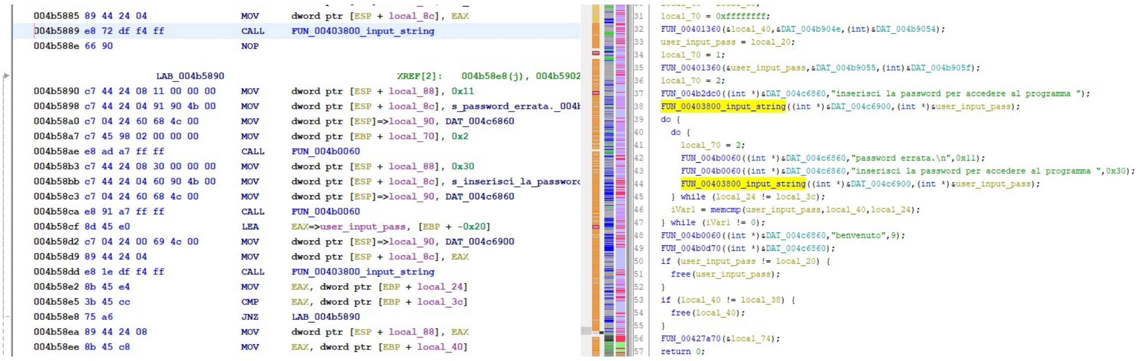

Listing: password.exe
password.exe
Decompile: FUN_004b57d0_main - (password.exe)
Decompile: FUN_004b57d...
Defined Data
Defined Strings
Functions

```
                        FUN_004b57d0_main                      XREF[1]:    FUN_00401000:
004b57d0 8d 4c 24 04       LEA      ECX=>param_1,[ESP + 0x4]
004b57d4 83 e4 f0          AND      ESP,0xfffffff0
004b57d7 ff 71 fc          PUSH     dword ptr [ECX + local_res0]
004b57da 55                PUSH     EBP
004b57db 89 e5             MOV      EBP,ESP
004b57dd 51                PUSH     ECX
004b57de 8d 45 f8          LEA      EAX=>local_10,[EBP + -0x8]
004b57e1 81 ec 84 00 00    SUB      ESP,0x84
         00
004b57e7 c7 45 ac d0 17    MOV      dword ptr [EBP + local_5c],LAB_004017d0
         40 00
004b57ee c7 45 b0 e0 5d    MOV      dword ptr [EBP + local_58],DAT_004b5de0         = 0401
         4b 00
004b57f5 89 45 b4          MOV      dword ptr [EBP + local_54],EAX
004b57f8 8d 45 94          LEA      EAX=>local_74,[EBP + -0x6c]
004b57fb 89 65 bc          MOV      dword ptr [EBP + local_4c],ESP
004b57fe c7 45 b8 65 59    MOV      dword ptr [EBP + local_50],LAB_004b5965
         4b 00
004b5805 89 04 24          MOV      dword ptr [ESP]=>local_90,EAX
004b5808 e8 03 21 f7 ff    CALL     FUN_00427910                                    undefi
004b580d e8 8e 18 f7 ff    CALL     FUN_004270a0                                    undefi
004b5812 8d 45 d0          LEA      EAX=>local_38,[EBP + -0x30]
004b5815 8d 4d c8          LEA      ECX=>local_40,[EBP + -0x38]
004b5818 89 45 c8          MOV      dword ptr [EBP + local_40],EAX
004b581b c7 44 24 04 54    MOV      dword ptr [ESP + local_8c],DAT_004b9054
         90 4b 00
004b5823 c7 04 24 4e 90    MOV      dword ptr [ESP]=>local_90,DAT_004b904e          = 64h
         4b 00
004b582a c7 45 98 ff ff    MOV      dword ptr [EBP + local_70],0xffffffff
         ff ff
004b5831 e8 2a bb f4 ff    CALL     FUN_00401360                                    undefi
004b5836 8d 45 e8          LEA      EAX=>local_20,[EBP + -0x18]
004b5839 83 ec 08          SUB      ESP,0x8
```

```
  undefined local_10 [4];
  undefined1 *local_c;

  local_c = &param_1;
  local_54 = local_10;
  local_4c = &stack0xffffff70;
  local_5c = &LAB_004017d0;
  local_58 = &DAT_004b5de0;
  local_50 = &LAB_004b5965;
  FUN_00427910(&local_74);
  FUN_004270a0();
  local_40 = local_38;
  local_70 = 0xffffffff;
  FUN_00401360(&local_40,&DAT_004b904e,(int)&DAT_004b9054);
  local_28 = local_20;
  local_70 = 1;
  FUN_00401360(&local_28,&DAT_004b9055,(int)&DAT_004b905f);
  local_70 = 2;
  FUN_004b2dc0((int *)&DAT_004c6860,"inserisci la password per accedere al programma ");
  FUN_00403800((int *)&DAT_004c6900,(int *)&local_28);
  do {
    do {
      local_70 = 2;
      FUN_004b0060((int *)&DAT_004c6860,"password errata.\n",0x11);
      FUN_004b0060((int *)&DAT_004c6860,"inserisci la password per accedere al programma ",0x30);
      FUN_00403800((int *)&DAT_004c6900,(int *)&local_28);
    } while (local_24 != local_3c);
    iVar1 = memcmp(local_28,local_40,local_24);
  } while (iVar1 != 0);
  FUN_004b0060((int *)&DAT_004c6860,"benvenuto",9);
  FUN_004b0d70((int *)&DAT_004c6860);
  if (local_28 != local_20) {
    free(local_28);
  }
  if (local_40 != local_38) {
    free(local_40);
  }
  FUN_00427a70(&local_74);
  return 0;
}
```

If we focus on the decompiled code we see that there is a function that repeats 2 times. One before starting a loop and one inside a loop. If we test the program we can verify that this is the data entry function where the password is requested.

The funny thing is that after asking for the password the first time it does not do any checking at all. It goes directly into the loop, so only the password we enter second is valid. The first time, even if it's a good one, it will always show us an error message and will ask us for the password again.

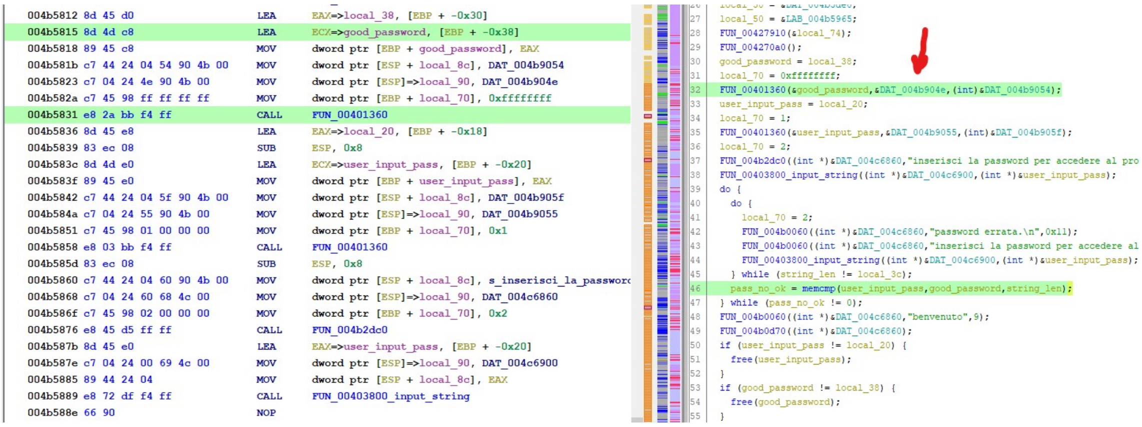


```
004b5885 89 44 24 04             MOV      dword ptr [ESP + local_8c], EAX
004b5889 e8 72 df f4 ff          CALL     FUN_00403800_input_string
004b588e 66 90                   NOP

                        LAB_004b5890                           XREF[2]:    004b58e8(j), 004b5902
004b5890 c7 44 24 08 11 00 00 00 MOV      dword ptr [ESP + local_88], 0x11
004b5898 c7 44 24 04 91 90 4b 00 MOV      dword ptr [ESP + local_8c], s_password_errata._004
004b58a0 c7 04 24 60 68 4c 00    MOV      dword ptr [ESP]=>local_90, DAT_004c6860
004b58a7 c7 45 98 02 00 00 00    MOV      dword ptr [EBP + local_70], 0x2
004b58ae e8 ad a7 ff ff          CALL     FUN_004b0060
004b58b3 c7 44 24 08 30 00 00 00 MOV      dword ptr [ESP + local_88], 0x30
004b58bb c7 44 24 04 60 90 4b 00 MOV      dword ptr [ESP + local_8c], s_inserisci_la_passwor
004b58c3 c7 04 24 60 68 4c 00    MOV      dword ptr [ESP]=>local_90, DAT_004c6860
004b58ca e8 91 a7 ff ff          CALL     FUN_004b0060
004b58cf 8d 45 e0                LEA      EAX=>user_input_pass, [EBP + -0x20]
004b58d2 c7 04 24 00 69 4c 00    MOV      dword ptr [ESP]=>local_90, DAT_004c6900
004b58d9 89 44 24 04             MOV      dword ptr [ESP + local_8c], EAX
004b58dd e8 1e df f4 ff          CALL     FUN_00403800_input_string
004b58e2 8b 45 e4                MOV      EAX, dword ptr [EBP + local_24]
004b58e5 3b 45 cc                CMP      EAX, dword ptr [EBP + local_3c]
004b58e8 75 a6                   JNZ      LAB_004b5890
004b58ea 89 44 24 08             MOV      dword ptr [ESP + local_88], EAX
004b58ee 8b 45 c8                MOV      EAX, dword ptr [EBP + local_40]
```

```
  local_70 = 0xffffffff;
  FUN_00401360(&local_40,&DAT_004b904e,(int)&DAT_004b9054);
  user_input_pass = local_20;
  local_70 = 1;
  FUN_00401360(&user_input_pass,&DAT_004b9055,(int)&DAT_004b905f);
  local_70 = 2;
  FUN_004b2dc0((int *)&DAT_004c6860,"inserisci la password per accedere al programma ");
  FUN_00403800_input_string((int *)&DAT_004c6900,(int *)&user_input_pass);
  do {
    do {
      local_70 = 2;
      FUN_004b0060((int *)&DAT_004c6860,"password errata.\n",0x11);
      FUN_004b0060((int *)&DAT_004c6860,"inserisci la password per accedere al programma ",0x30);
      FUN_00403800_input_string((int *)&DAT_004c6900,(int *)&user_input_pass);
    } while (local_24 != local_3c);
    iVar1 = memcmp(user_input_pass,local_40,local_24);
  } while (iVar1 != 0);
  FUN_004b0060((int *)&DAT_004c6860,"benvenuto",9);
  FUN_004b0d70((int *)&DAT_004c6860);
  if (user_input_pass != local_20) {
    free(user_input_pass);
  }
  if (local_40 != local_38) {
    free(local_40);
  }
  FUN_00427a70(&local_74);
  return 0;
```

We see that the check is done with 2 nested loops. The first one verifies that the length of the string is the expected one, therefore we can already identify which variables refer to the length of the password. Then the **memcmp()** function is called which compares two strings in memory and returns an integer indicating s and one string is greater than another or they are the same. If the returned result is 0, it means that the strings are the same.

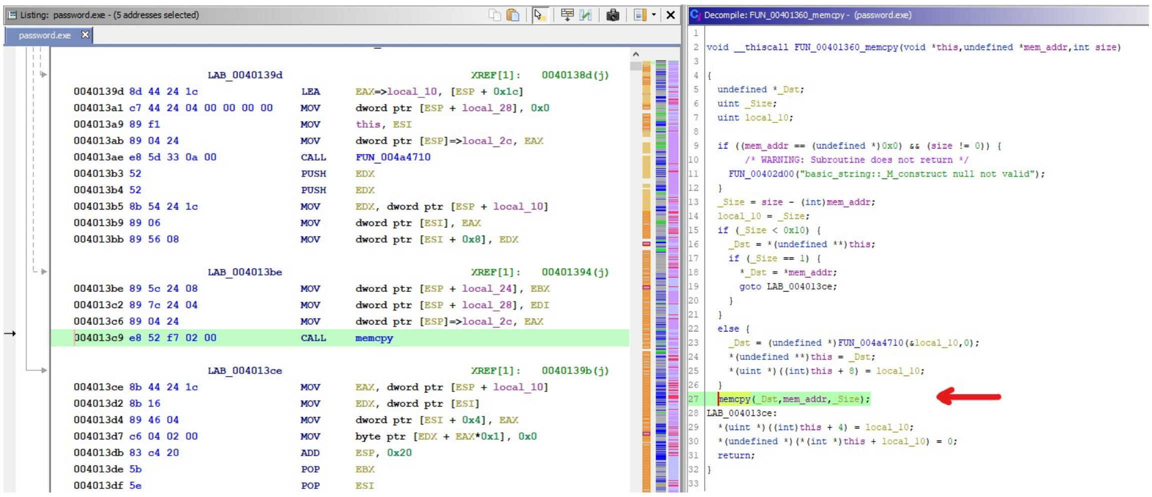
So, let's change a few more variable names.



```
004b5812 8d 45 d0                LEA     EAX=>local_38, [EBP + -0x30]
004b5815 8d 4d c8                LEA     ECX=>good_password, [EBP + -0x38]
004b5818 89 45 c8                MOV     dword ptr [EBP + good_password], EAX
004b581b c7 44 24 04 54 90 4b 00 MOV     dword ptr [ESP + local_8c], DAT_004b9054
004b5823 c7 04 24 4e 90 4b 00    MOV     dword ptr [ESP]=>local_90, DAT_004b904e
004b582a c7 45 98 ff ff ff ff    MOV     dword ptr [EBP + local_70], 0xffffffff
004b5831 e8 2a bb f4 ff          CALL    FUN_00401360
004b5836 8d 45 e8                LEA     EAX=>local_20, [EBP + -0x18]
004b5839 83 ec 08                SUB     ESP, 0x8
004b583c 8d 4d e0                LEA     ECX=>user_input_pass, [EBP + -0x20]
004b583f 89 45 e0                MOV     dword ptr [EBP + user_input_pass], EAX
004b5842 c7 44 24 04 5f 90 4b 00 MOV     dword ptr [ESP + local_8c], DAT_004b905f
004b584a c7 04 24 55 90 4b 00    MOV     dword ptr [ESP]=>local_90, DAT_004b9055
004b5851 c7 45 98 01 00 00 00    MOV     dword ptr [EBP + local_70], 0x1
004b5858 e8 03 bb f4 ff          CALL    FUN_00401360
004b585d 83 ec 08                SUB     ESP, 0x8
004b5860 c7 44 24 04 60 90 4b 00 MOV     dword ptr [ESP + local_8c], s_inserisci_la_passworc
004b5868 c7 04 24 60 68 4c 00    MOV     dword ptr [ESP]=>local_90, DAT_004c6860
004b586f c7 45 98 02 00 00 00    MOV     dword ptr [EBP + local_70], 0x2
004b5876 e8 45 d5 ff ff          CALL    FUN_004b2dc0
004b587b 8d 45 e0                LEA     EAX=>user_input_pass, [EBP + -0x20]
004b587e c7 04 24 00 69 4c 00    MOV     dword ptr [ESP]=>local_90, DAT_004c6900
004b5885 89 44 24 04             MOV     dword ptr [ESP + local_8c], EAX
004b5889 e8 72 df f4 ff          CALL    FUN_00403800_input_string
004b588e 66 90                   NOP
```

```
  local_50 = &LAB_004b5965;
  FUN_00427910(&local_74);
  FUN_004270a0();
  good_password = local_38;
  local_70 = 0xffffffff;
  FUN_00401360(&good_password,&DAT_004b904e,(int)&DAT_004b9054);
  user_input_pass = local_20;
  local_70 = 1;
  FUN_00401360(&user_input_pass,&DAT_004b9055,(int)&DAT_004b905f);
  local_70 = 2;
  FUN_004b2dc0((int *)&DAT_004c6860,"inserisci la password per accedere al pro
  FUN_00403800_input_string((int *)&DAT_004c6900,(int *)&user_input_pass);
  do {
    do {
      local_70 = 2;
      FUN_004b0060((int *)&DAT_004c6860,"password errata.\n",0x11);
      FUN_004b0060((int *)&DAT_004c6860,"inserisci la password per accedere al
      FUN_00403800_input_string((int *)&DAT_004c6900,(int *)&user_input_pass);
    } while (string_len != local_3c);
    pass_no_ok = memcmp(user_input_pass,good_password,string_len);
  } while (pass_no_ok != 0);
  FUN_004b0060((int *)&DAT_004c6860,"benvenuto",9);
  FUN_004b0d70((int *)&DAT_004c6860);
  if (user_input_pass != local_20) {
    free(user_input_pass);
  }
  if (good_password != local_38) {
    free(good_password);
  }
```

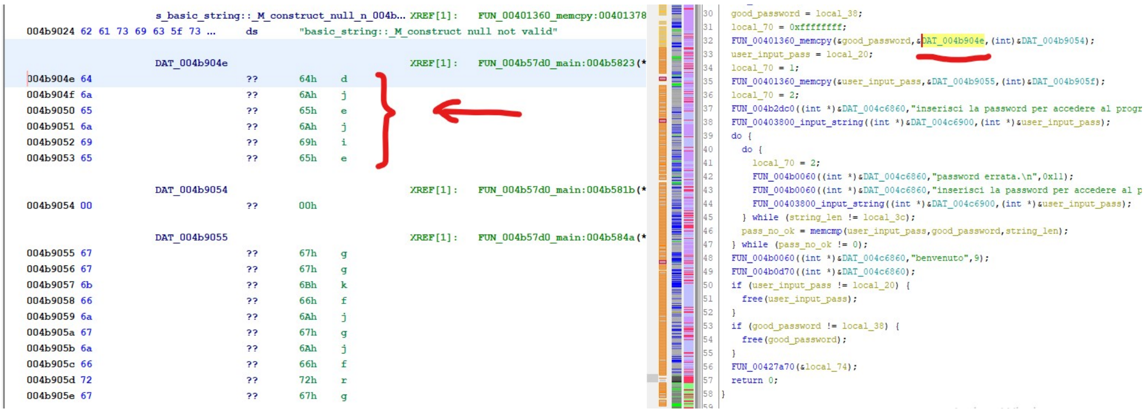
We can now see a variable that we will call **"good_password"** in which it is assumed that we have the password that is the correct one. A little further up, before entering the loop, a function is called with reference to this variable. Let's see what it does.


Listing: password.exe - (5 addresses selected)
password.exe
Decompile: FUN_00401360_memcpy - (password.exe)

```
                     LAB_0040139d                          XREF[1]:   0040138d(j)
0040139d 8d 44 24 1c             LEA     EAX=>local_10, [ESP + 0x1c]
004013a1 c7 44 24 04 00 00 00 00 MOV     dword ptr [ESP + local_28], 0x0
004013a9 89 f1                   MOV     this, ESI
004013ab 89 04 24                MOV     dword ptr [ESP]=>local_2c, EAX
004013ae e8 5d 33 0a 00          CALL    FUN_004a4710
004013b3 52                      PUSH    EDX
004013b4 52                      PUSH    EDX
004013b5 8b 54 24 1c             MOV     EDX, dword ptr [ESP + local_10]
004013b9 89 06                   MOV     dword ptr [ESI], EAX
004013bb 89 56 08                MOV     dword ptr [ESI + 0x8], EDX

                     LAB_004013be                          XREF[1]:   00401394(j)
004013be 89 5c 24 08             MOV     dword ptr [ESP + local_24], EBX
004013c2 89 7c 24 04             MOV     dword ptr [ESP + local_28], EDI
004013c6 89 04 24                MOV     dword ptr [ESP]=>local_2c, EAX
004013c9 e8 52 f7 02 00          CALL    memcpy

                     LAB_004013ce                          XREF[1]:   0040139b(j)
004013ce 8b 44 24 1c             MOV     EAX, dword ptr [ESP + local_10]
004013d2 8b 16                   MOV     EDX, dword ptr [ESI]
004013d4 89 46 04                MOV     dword ptr [ESI + 0x4], EAX
004013d7 c6 04 02 00             MOV     byte ptr [EDX + EAX*0x1], 0x0
004013db 83 c4 20                ADD     ESP, 0x20
004013de 5b                      POP     EBX
004013df 5e                      POP     ESI
```

```

void __thiscall FUN_00401360_memcpy(void *this,undefined *mem_addr,int size)

{
  undefined *_Dst;
  uint _Size;
  uint local_10;

  if ((mem_addr == (undefined *)0x0) && (size != 0)) {
        /* WARNING: Subroutine does not return */
    FUN_00402d00("basic_string::_M_construct null not valid");
  }
  _Size = size - (int)mem_addr;
  local_10 = _Size;
  if (_Size < 0x10) {
    _Dst = *(undefined **)this;
    if (_Size == 1) {
      *_Dst = *mem_addr;
      goto LAB_004013ce;
    }
  }
  else {
    _Dst = (undefined *)FUN_004a4710(&local_10,0);
    *(undefined **)this = _Dst;
    *(uint *)((int)this + 8) = local_10;
  }
  memcpy(_Dst,mem_addr,_Size);
LAB_004013ce:
  *(uint *)((int)this + 4) = local_10;
  *(undefined *)(*(int *)this + local_10) = 0;
  return;
}
```

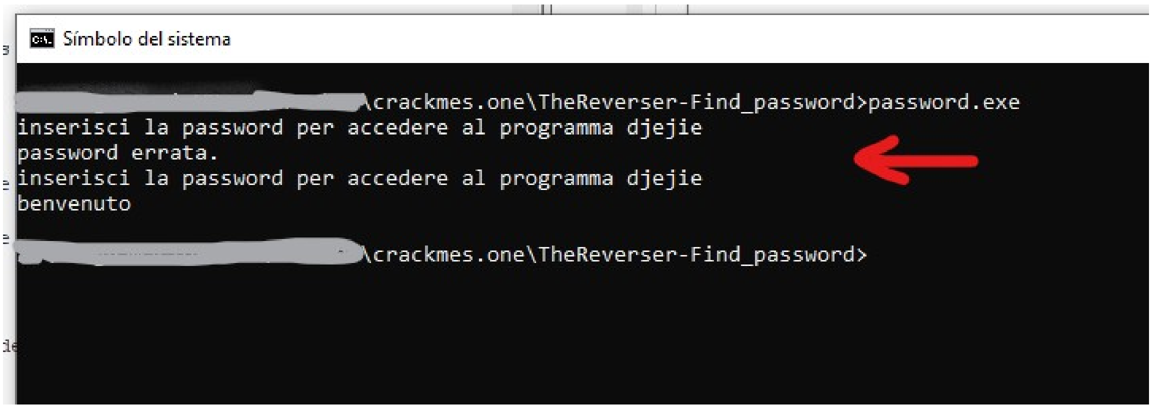
This function copies the contents of one memory area over another. A copy of literal strings. So let's see what is in that memory area pointed to by **&DAT_004b904e**.



```
                     s_basic_string::_M_construct_null_n_004b... XREF[1]:   FUN_00401360_memcpy:00401378
004b9024 62 61 73 69 63 5f 73 ...   ds      "basic_string::_M_construct null not valid"

                     DAT_004b904e                          XREF[1]:   FUN_004b57d0_main:004b5823(*
004b904e 64                         ??      64h    d
004b904f 6a                         ??      6Ah    j
004b9050 65                         ??      65h    e
004b9051 6a                         ??      6Ah    j
004b9052 69                         ??      69h    i
004b9053 65                         ??      65h    e

                     DAT_004b9054                          XREF[1]:   FUN_004b57d0_main:004b581b(*
004b9054 00                         ??      00h

                     DAT_004b9055                          XREF[1]:   FUN_004b57d0_main:004b584a(*
004b9055 67                         ??      67h    g
004b9056 67                         ??      67h    g
004b9057 6b                         ??      6Bh    k
004b9058 66                         ??      66h    f
004b9059 6a                         ??      6Ah    j
004b905a 67                         ??      67h    g
004b905b 6a                         ??      6Ah    j
004b905c 66                         ??      66h    f
004b905d 72                         ??      72h    r
004b905e 67                         ??      67h    g
```

```
  good_password = local_38;
  local_70 = 0xffffffff;
  FUN_00401360_memcpy(&good_password,&DAT_004b904e,(int)&DAT_004b9054);
  user_input_pass = local_20;
  local_70 = 1;
  FUN_00401360_memcpy(&user_input_pass,&DAT_004b9055,(int)&DAT_004b905f);
  local_70 = 2;
  FUN_004b2dc0((int *)&DAT_004c6860,"inserisci la password per accedere al progr
  FUN_00403800_input_string((int *)&DAT_004c6900,(int *)&user_input_pass);
  do {
    do {
      local_70 = 2;
      FUN_004b0060((int *)&DAT_004c6860,"password errata.\n",0x11);
      FUN_004b0060((int *)&DAT_004c6860,"inserisci la password per accedere al p
      FUN_00403800_input_string((int *)&DAT_004c6900,(int *)&user_input_pass);
    } while (string_len != local_3c);
    pass_no_ok = memcmp(user_input_pass,good_password,string_len);
  } while (pass_no_ok != 0);
  FUN_004b0060((int *)&DAT_004c6860,"benvenuto",9);
  FUN_004b0d70((int *)&DAT_004c6860);
  if (user_input_pass != local_20) {
    free(user_input_pass);
  }
  if (good_password != local_38) {
    free(good_password);
  }
  FUN_00427a70(&local_74);
  return 0;
}
```

Here we can see that the text there is **"djejie"**. Can this be the password? Surely. Let's check it ...



```
[redacted]\crackmes.one\TheReverser-Find_password>password.exe
inserisci la password per accedere al programma djejie
password errata.
inserisci la password per accedere al programma djejie
benvenuto

[redacted]\crackmes.one\TheReverser-Find_password>
```

Here we can see how the first time it tells us that the password is incorrect, but in the next attempt it is accepted. This is probably done to mislead the user, or perhaps it is a programmer error. In any case we already have the solution.

That's all folks!