

1. a. compile with debug symbol:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ make all
gcc -g3 -Wall -c -o main.o main.c
gcc -g3 -Wall -c -o bugs.o bugs.c
bugs.c: In function 'bugYuval':
bugs.c:5:15: warning: division by zero [-Wdiv-by-zero]
    5 |         int x = 5 / 0;
      |                   ^
gcc -g3 -Wall main.o bugs.o -o mains
```

b. compile without debug symbol (deleted "-g3" from the makefile):

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ make all
gcc -Wall -c -o main.o main.c
gcc -Wall -c -o bugs.o bugs.c
bugs.c: In function 'bugYuval':
bugs.c:5:15: warning: division by zero [-Wdiv-by-zero]
    5 |         int x = 5 / 0;
      |                   ^
gcc -Wall main.o bugs.o -o mains
```

2. run the program:

Bug A:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ ./mains
What bug type would you like to see? (1, 2, or 3)
1
Floating point exception (core dumped)
```

Bug B:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ ./mains
What bug type would you like to see? (1, 2, or 3)
2
Segmentation fault (core dumped)
```

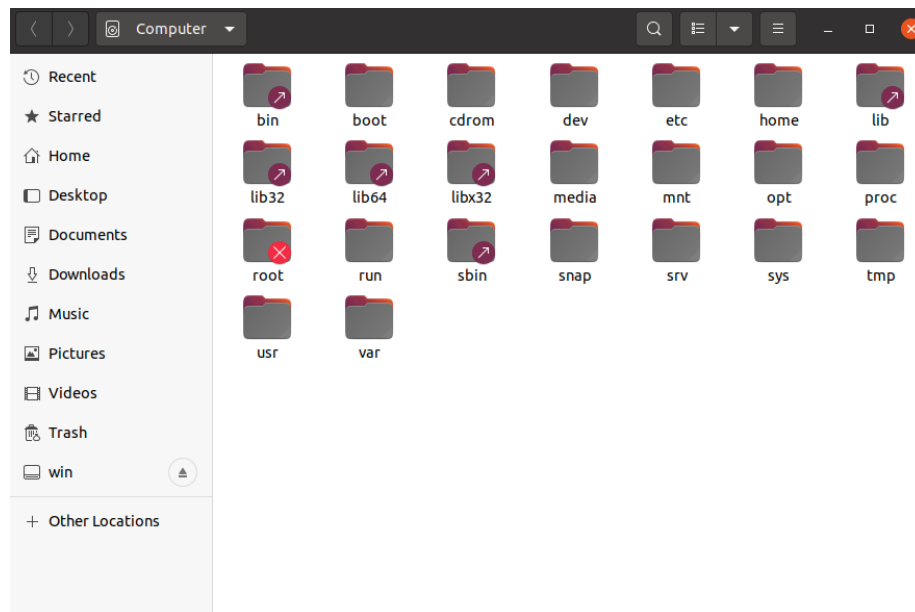
Bug C:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ ./mains
What bug type would you like to see? (1, 2, or 3)
3
Segmentation fault (core dumped)
```

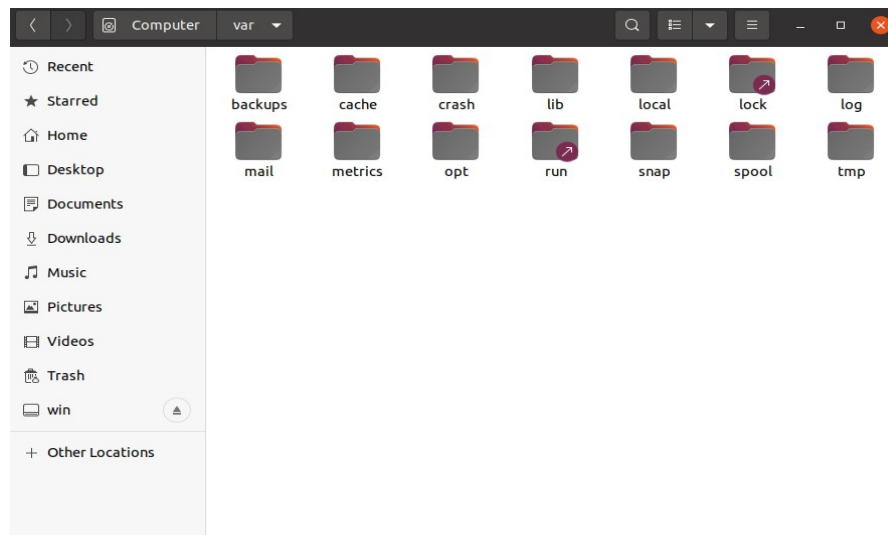
3. show the necessary steps to get core:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ ulimit -c unlimited
```

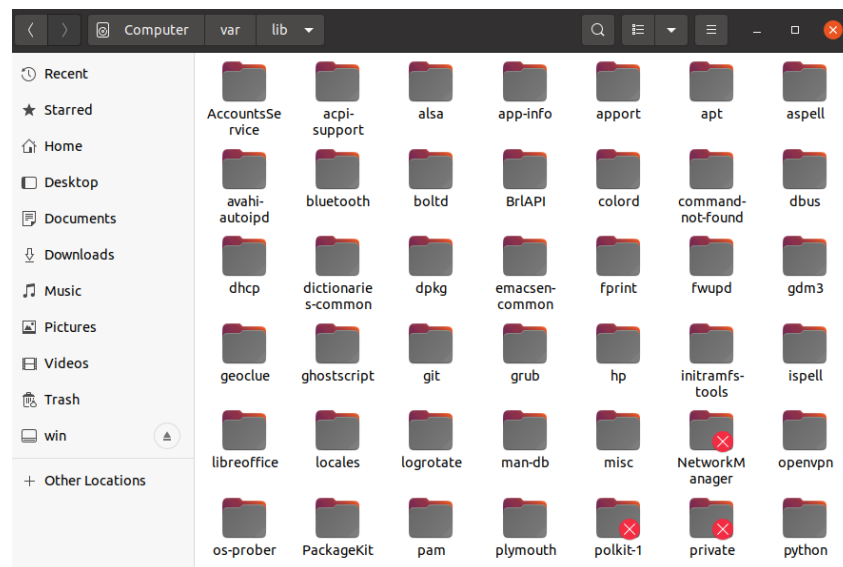
→ computer



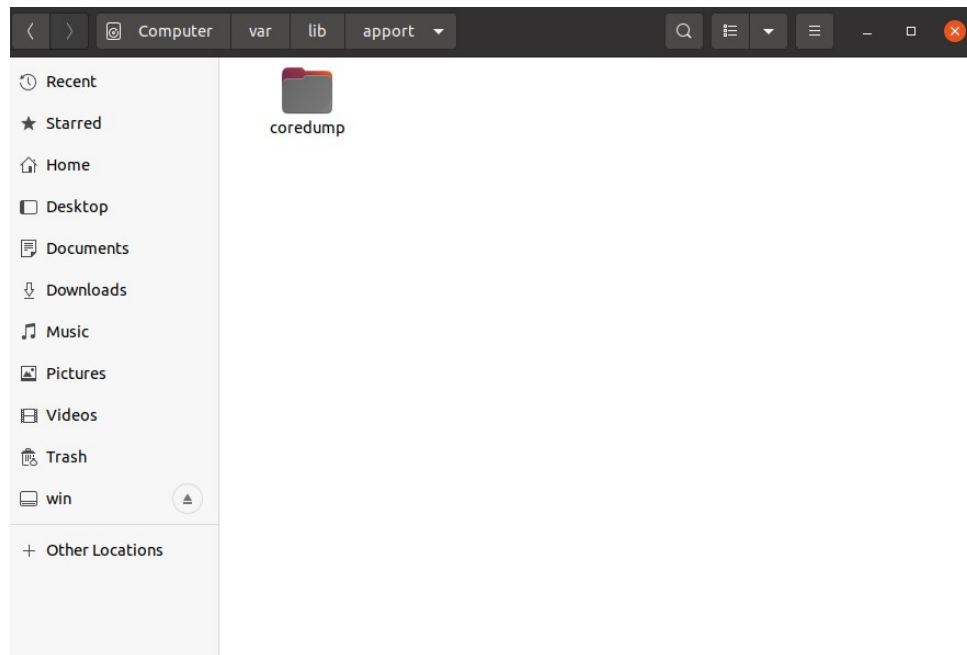
→ var



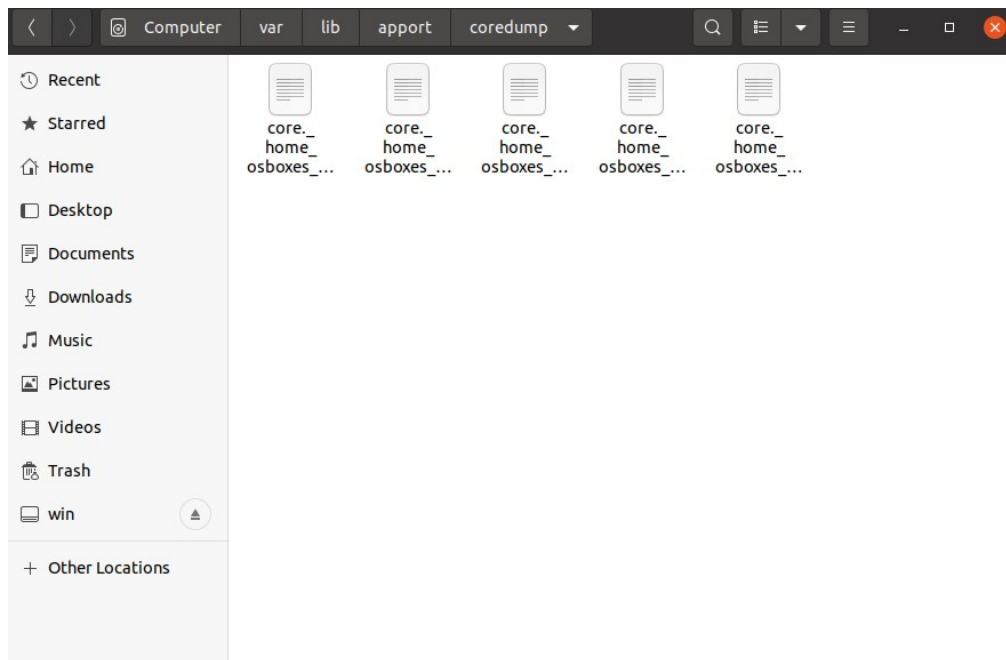
→ lib



→ apport



→ coredump



then we copied the core files into the current working directory and changed their names accordingly.

4.a. load in gdb with debug symbol:

Bug A:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ gdb -c core1_with-debug.3931870 ./mains
GNU gdb (Ubuntu 9.2-0ubuntu1~20.04.1) 9.2
Copyright (C) 2020 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./mains...
[New LWP 30220]
Core was generated by `./mains'.
Program terminated with signal SIGFPE, Arithmetic exception.
#0  0x000055c49e90b2e3 in bugYuval () at bugs.c:5
5      int x = 5 / 0;
(gdb) █
```

Bug B:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ gdb -c core2_with-debug.3936340 ./mains
GNU gdb (Ubuntu 9.2-0ubuntu1~20.04.1) 9.2
Copyright (C) 2020 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./mains...
[New LWP 30241]
Core was generated by `./mains'.
Program terminated with signal SIGSEGV, Segmentation fault.
#0  bugOhad () at bugs.c:13
13     arr[809305734] = 95;
(gdb) █
```

Bug C:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ gdb -c core3_with-debug.3942897 ./mains
GNU gdb (Ubuntu 9.2-0ubuntu1~20.04.1) 9.2
Copyright (C) 2020 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
  <http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./mains...
[New LWP 30263]
Core was generated by './mains'.
Program terminated with signal SIGSEGV, Segmentation fault.
#0  0x000055fb6e94833f in bugShira () at bugs.c:20
20      bugShira();
(gdb) █
```

b. load in gdb without debug symbol:

Bug A:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ gdb -c core1_no-debug.3886130 ./mains
GNU gdb (Ubuntu 9.2-0ubuntu1~20.04.1) 9.2
Copyright (C) 2020 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
  <http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./mains...
(No debugging symbols found in ./mains)
[New LWP 29909]
Core was generated by './mains'.
Program terminated with signal SIGFPE, Arithmetic exception.
#0  0x0000557bda9eb2e3 in bugYuval ()
(gdb) █
```

Bug B:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ gdb -c core2_no-debug.3891882 ./mains
GNU gdb (Ubuntu 9.2-0ubuntu1~20.04.1) 9.2
Copyright (C) 2020 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
  <http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./mains...
(No debugging symbols found in ./mains)

[New LWP 29929]
Core was generated by './mains'.
Program terminated with signal SIGSEGV, Segmentation fault.
#0  0x00005593c49ae319 in bug0had ()
(gdb)
```

Bug C:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ gdb -c core3_no-debug.3895535 ./mains
GNU gdb (Ubuntu 9.2-0ubuntu1~20.04.1) 9.2
Copyright (C) 2020 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
  <http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./mains...
(No debugging symbols found in ./mains)

[New LWP 29941]
Core was generated by './mains'.
Program terminated with signal SIGSEGV, Segmentation fault.
#0  0x000055bad1a5d33f in bugShira ()
(gdb)
```

5. show the relevant row in the code where the program crashed with core

Bug A:

```
Program terminated with signal SIGFPE, Arithmetic exception.
#0  0x000055c49e90b2e3 in bugYuval () at bugs.c:5
5      int x = 5 / 0;
(gdb)
```



```
Program terminated with signal SIGFPE, Arithmetic exception.
#0  0x000055c49e90b2e3 in bugYuval () at bugs.c:5
5      int x = 5 / 0;
(gdb) l
1      #include <stdlib.h>
2
3      int bugYuval()
4      {
5          int x = 5 / 0;
6          x++;
7          return 0;
8      }
9
10     int bugOhad()
(gdb) █
```

Bug B:

```
Program terminated with signal SIGSEGV, Segmentation fault.
#0  bugOhad () at bugs.c:13
13     arr[809305734] = 95;
(gdb) █
```

```
Program terminated with signal SIGSEGV, Segmentation fault.
#0  bugOhad () at bugs.c:13
13     arr[809305734] = 95;
(gdb) l
8     }
9
10    int bugOhad()
11    {
12        int* arr = malloc(5);
13        arr[809305734] = 95;
14        free(arr);
15        return 0;
16    }
17
(gdb) █
```

Bug C:

```
Program terminated with signal SIGSEGV, Segmentation fault.
```

```
#0 0x000055fb6e94833f in bugShira () at bugs.c:20
```

```
20      bugShira();
```

```
(gdb) █
```

```
Program terminated with signal SIGSEGV, Segmentation fault.
```

```
#0 0x000055fb6e94833f in bugShira () at bugs.c:20
```

```
20      bugShira();
```

```
(gdb) l
```

```
15      return 0;
```

```
16  }
```

```
17
```

```
18  int bugShira()
```

```
19  {
```

```
20      bugShira();
```

```
21      return 0;
```

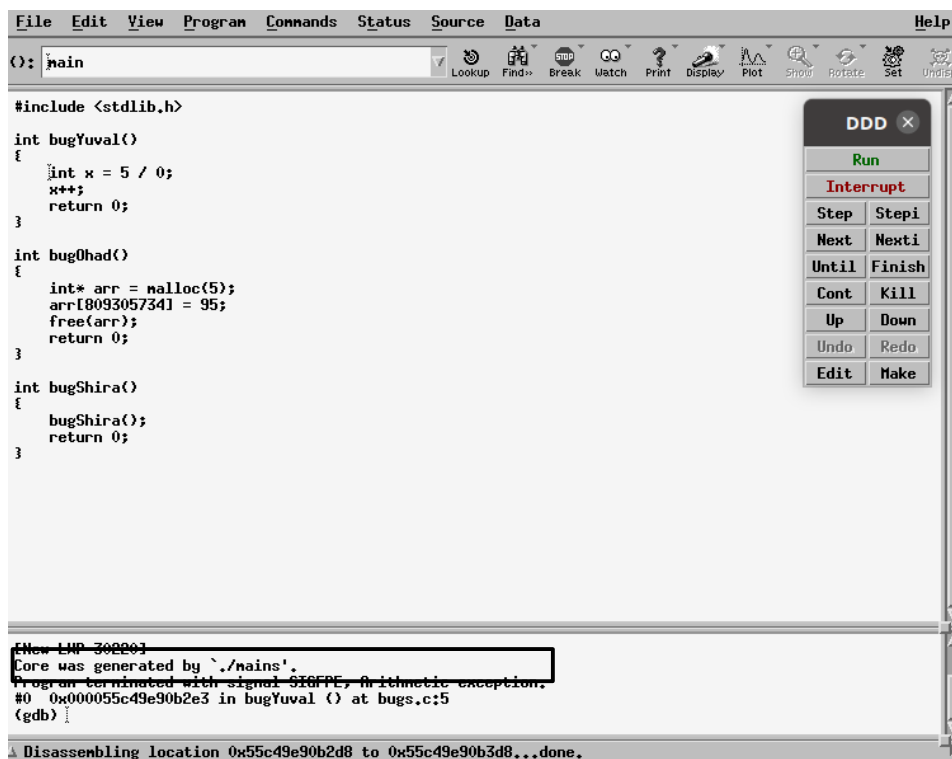
```
22  }
```

```
(gdb) █
```

6. open the core with a graphic debugger (such as ddd):

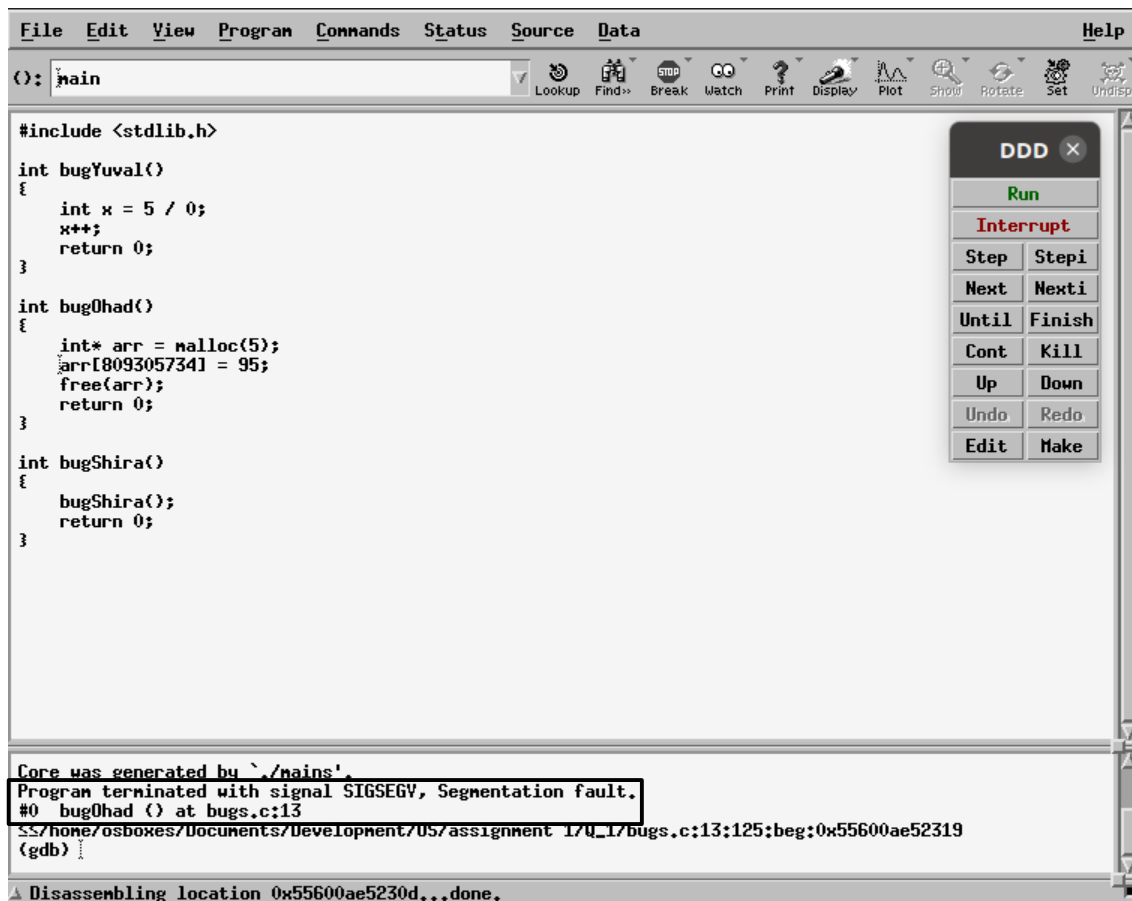
Bug A:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ ddd -c core1_with-d  
ebug.3931870 ./mains
```



Bug B:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ ddd -c core2_with-debug.3936340 ./mains
```



Bug C:

```
osboxes@osboxes:~/Documents/Development/OS/assignment 1/Q_1$ ddd -c core3_with-debug.3942897 ./mains
```

