

Lab 3

*School of Architecture, Civil and
Environmental Engineering*

EPFL, SS 2018-2019

http://disal.epfl.ch/teaching/signals_instruments_systems/

Lab 3 outline

- This lab has three main goals:
 - Pointers
 - Structures in C
 - How to debug
- New tools:
 - GDB debugger

Pointers

- A pointer is a **variable** that contains **the address of another variable**.
- A pointer can be declared as follows:

Type* name

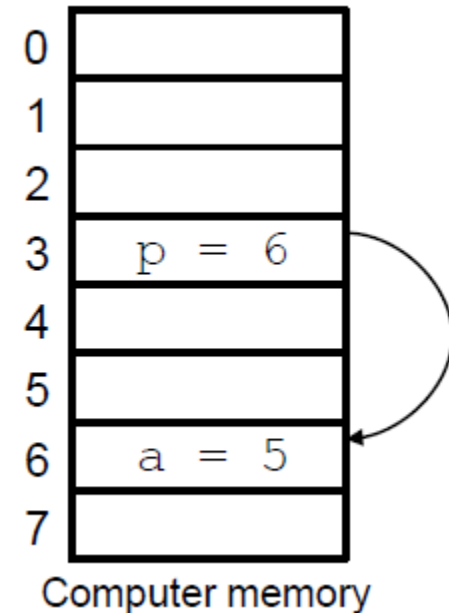
- A pointer can be dereferenced using symbol *

(*name)

- To obtain the address of another variable, the operator & can be used:

```
int a = 5;
int* p = &a;
```

	Type	Address	Value
a	int	6	5
p	int*	3	6



Pointers

- Never access the memory you did not allocate (e.g., exceed an array bound)

- Always use `malloc` and `free` in pair

```
Type* pName =(Type*)malloc(length*sizeof(Type));  
free(pName);
```

- Be careful about termination character (`\0`) in strings

struct basics

- Definition of a structure:

```
struct <struct-type>{  
    <type> <identifier>;  
    <type> <identifier>;  
    ...  
} ;
```

} Each identifier defines a member of the structure.

- Example:

```
struct Date {  
    int day;  
    int month;  
    int year;  
} ;
```

} The “Date” structure has 3 members, day, month & year.

Using struct

```
struct Date {  
    int day;  
    int month;  
    int year;  
} ;
```

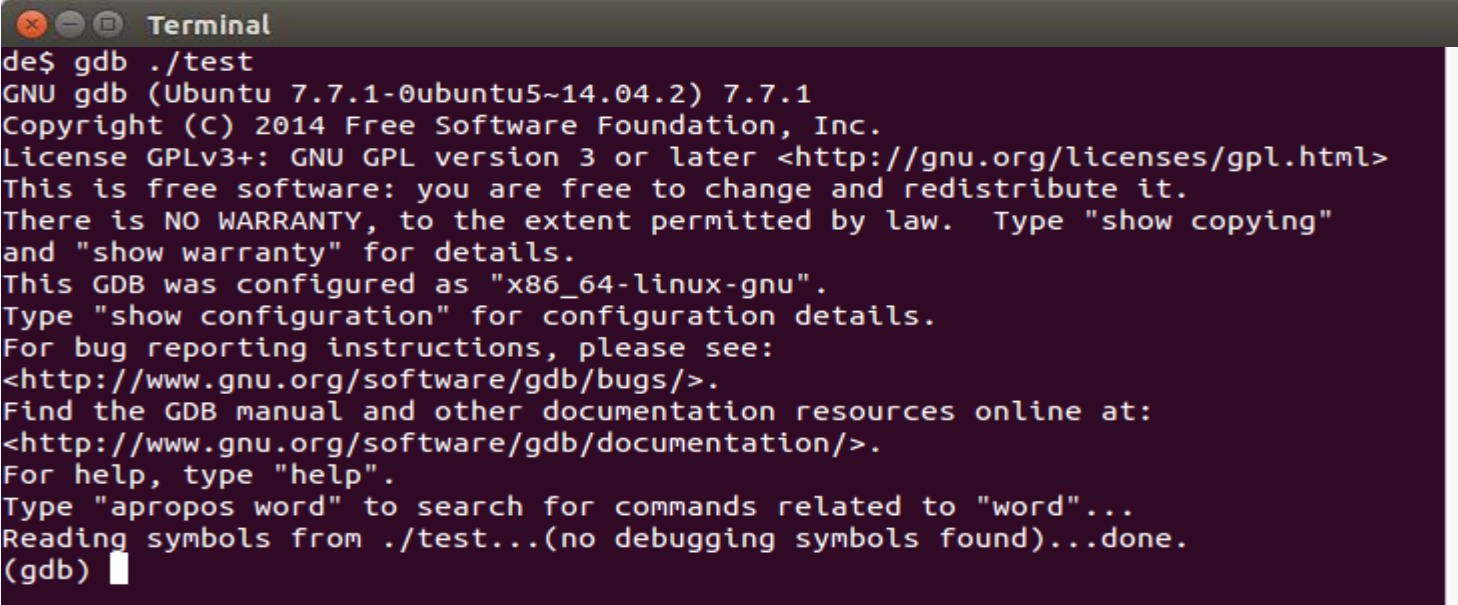
- `struct Date date1;`
 - instance
- `struct Date* date2;`
 - Pointer to a struct
- For accessing day:
 - `date1.day`
 - `date2->day`

What is gdb?

- GDB is the GNU Project debugger
- gdb provides some helpful functionality
 - Allows you to stop your program at any given point.
 - You can examine the state of your program when it's stopped.

Using gdb:

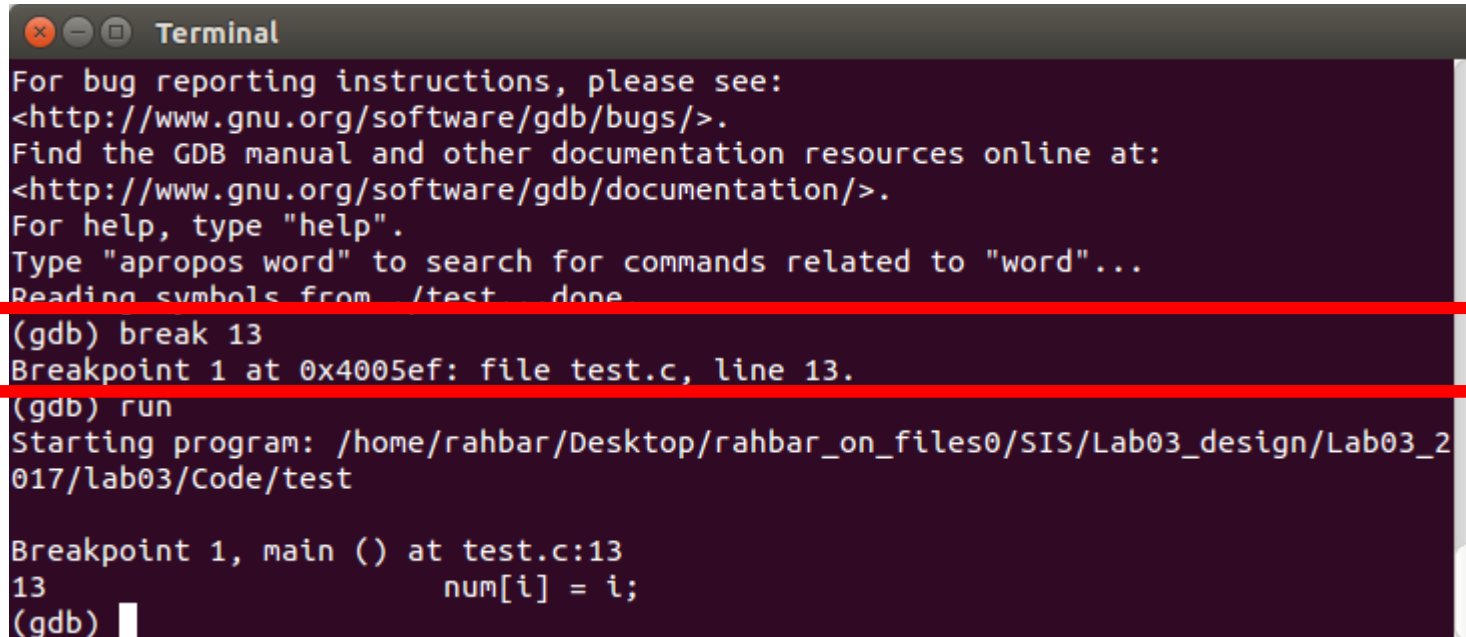
- To start gdb with your hello program type:
`gdb ./test`
- When gdb starts, your program is not actually running.



```
Terminal
de$ gdb ./test
GNU gdb (Ubuntu 7.7.1-0ubuntu5~14.04.2) 7.7.1
Copyright (C) 2014 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 ./test...(no debugging symbols found)...done.
(gdb) █
```


Using gdb:

- You have to use the **run** command to start execution.
- Before you do that, you should place some break points.
- Once you hit a break point, you can examine any variable.



```
Terminal
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 /test: done
(gdb) break 13
Breakpoint 1 at 0x4005ef: file test.c, line 13.
(gdb) run
Starting program: /home/rahbar/Desktop/rahbar_on_files0/SIS/Lab03_design/Lab03_2
017/lab03/Code/test

Breakpoint 1, main () at test.c:13
13          num[i] = i;
(gdb) |
```

Useful gdb commands

- **break *place***
 - ***place*** can be the name of a function or a line number
 - For example: **break main** will stop execution at the first instruction of your program
- **delete *N***
 - Removes breakpoints, where ***N*** is the number of the breakpoint
- **step**
 - Executes current instruction and stops on the next one
- **next**
 - Same as **step** except this doesn't step into functions

Gdb commands cont.

- **run *command-line-arguments***
 - Begin execution of your program with arguments
- **print *E***
 - Prints the value of any variable in your program when you are at a breakpoint, where ***E*** is the name of the variable you want to print
- **help *command***
 - Gives you more information about any command or all if you leave out command
- **quit**
 - Exit gdb

Finally

- Do not forget to provide feedback through Moodle