Debugging

CS 113: Introduction to C

Instructor: Saikat Guha

Cornell University

Fall 2006, Lecture 5

Print Debugging

- Manually insert debugging statements
- Debugging statements print to screen
  - Caution: `stdout` is buffered. `printf` output may not appear before program crashes.
  - Solution: `stderr` is unbuffered.

printf debugging

```
fprintf(stderr, "%d %p", i, p);
```

- %d – `int`
- %s – `char *`
- %p – any pointer
- see man page for others `$ man 3 printf`

debug.c: Trace Information

```
#include <stdio.h>

int main(int argc, char **argv) {
  fprintf(stderr, "%s:%d:%s\t%s\n", __FILE__,
      __LINE__, __FUNCTION__, argv[0]);

  fprintf(stderr, "%s:%d:%s\t%s\n", __FILE__,
      __LINE__, __FUNCTION__, argv[1]);

  fprintf(stderr, "%s:%d:%s\t%s\n", __FILE__,
      __LINE__, __FUNCTION__, argv[2]);
}
```

```
debug.c:5:main ./test
debug.c:8:main hello
debug.c:11:main world
```

GDB: GNU Debugger

```
[saikat@submit cs113]$ gcc -g -o cmd cmd.c
[saikat@submit cs113]$ ./cmd foo
Segmentation fault
[saikat@submit cs113]$ gdb ./cmd
...
(gdb) b main
Breakpoint 1 at 0x80483a4:  file cmd.c, line 3.
(gdb) r foo
...
Breakpoint 1, main (argc=1209306428, argv=0x4802f4c6) at
cmd.c:3
3 int main(int argc, char **argv) {
(gdb) n
main (argc=2, argv=0xbfb646e4) at cmd.c:6
6 n = atoi(argv[1]);
(gdb) p argc
$1 = 2
```

GDB: GNU Debugger

```
(gdb) p argv[0]
$2 = 0xbfb65c84 "/home/netid/cs113/cmd"
(gdb) c
Continuing.

Program received signal SIGSEGV, Segmentation fault.
0x48045eae in ___strtol_l_internal () from /lib/libc.so.6
(gdb) bt
#0 0x48045eae in ___strtol_l_internal () from
/lib/libc.so.6
#1 0x48045c57 in __strtol_internal () from /lib/libc.so.6
#2 0x48043511 in atoi () from /lib/libc.so.6
#3 0x080483eb in main (argc=2, argv=0xbfb646e4) at cmd.c:7
(gdb) fr 3
#3 0x080483eb in main (argc=2, argv=0xbfb646e4) at cmd.c:7
7 m = atoi(argv[2]);
(gdb) p argv[2]
$3 = 0x0
```

GDB: Commands

- b <function> – Breakpoint on entering function
- r <args> – Run program
- list – print C code
- n – execute one statement
- s – execute one step (step into function calls)
- c – Continue running program
- p <variable> – print the value of a variable
- bt – Backtrace the stack
- fr <num> – Make stackframe <num> current frame for printing variables
- q – Quit
- help – More GDB help