

Programming with C I

Fangtian Zhong
CSCI 112

Gianforte School of Computing
Norm Asbjornson College of Engineering
E-mail: fangtian.zhong@montana.edu

What is Valgrind?



Valgrind is a flexible program for debugging and profiling Linux executables. Most important usage of valgrind is when you try to find memory leaks.

Download valgrind

```
$ sudo apt-get install valgrind
```

How to use a Valgrind



You can choose what tool you want to use with Valgrind. I explain only **memcheck** which is mostly used and important to check program errors.




```
--tool=<toolname> [default: memcheck]
```

Run the Valgrind tool called toolname,
e.g. **memcheck**, cachegrind, callgrind, helgrind, drd, massif, lackey, none,
exp-sgcheck, exp-bbv, exp-dhat, etc.

memcheck

- **Memcheck is a memory error detector. It can detect the following problems that are common in C programs.**
- 🛡️ **Accessing memory you shouldn't:** e.g. overrunning and underrunning heap blocks, overrunning the top of the stack, and accessing memory after it has been freed.
- 🛡️ **Using undefined values:** i.e. values that have not been initialized, or that have been derived from other undefined values.
- 🛡️ **Incorrect freeing of heap memory:** such as double-freeing heap blocks, or mismatched use of malloc versus free

memcheck

- **Memcheck is a memory error detector. It can detect the following problems that are common in C programs.**
-  **Overlapping src and dst pointers in memcpy and related functions.**
-  **Passing a fishy (presumably negative) value to the size parameter of a memory allocation function.**
-  **Memory leaks.**

Run for a real use case

Memory leak example

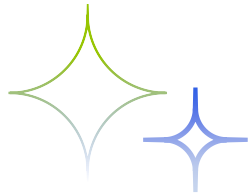
```
#include <stdio.h>
#include<stdlib.h>
void uninitialized_read(){
    int *ptr;
    printf("Unitialized value: %d\n", *ptr);
};
void memory_leak(){
    int* ptr =(int*) malloc(10*sizeof(int));
    ptr[10]=0;
};
```

```
int main()
{
    uninitialized_read();
    memory_leak();
    return 0;
}
```

Run for a real use case

Run valgrind to check memory leak

```
$ valgrind --tool=memcheck ./a.out
```



THE END

Fangtian Zhong
CSCI 112

2025.04.23

Gianforte School of Computing
Norm Asbjornson College of Engineering
E-mail: fangtian.zhong@montana.edu