

1. Segmentation fault.

2.

Starting program: /home/pi/hw/null.out

Program received signal SIGSEGV, Segmentation fault.
0x000104d4 in main (argc=1, argv=0x7eff6a4) at null.c:7
7 printf("%d\n", *x);

Signal	Value	Action	Comment
SIGSEGV	11	Core	Invalid memory reference

3. *****

```
==25687== Invalid read of size 4
==25687==   at 0x104D4: main (null.c:7)
==25687== Address 0x0 is not stack'd, malloc'd or (recently) free'd

==25687== Process terminating with default action of signal 11 (SIGSEGV)
==25687== Access not within mapped region at address 0x0
==25687==   at 0x104D4: main (null.c:7)

==25687== HEAP SUMMARY:
==25687==   in use at exit: 4 bytes in 1 blocks
==25687== total heap usage: 1 allocs, 0 frees, 4 bytes allocated
==25687==
==25687== 4 bytes in 1 blocks are definitely lost in loss record 1 of 1
==25687==   at 0x4849CE0: calloc (vg_replace_malloc.c:711)
==25687==   by 0x104BF: main (null.c:5)
*****
```

`x` is at the address 0x0, it's not belong to the program.

4. It runs, No.

```
==26394== HEAP SUMMARY:
==26394==   in use at exit: 4 bytes in 1 blocks
==26394== total heap usage: 2 allocs, 1 frees, 1,028 bytes allocated
==26394==
==26394== 4 bytes in 1 blocks are definitely lost in loss record 1 of 1
==26394==   at 0x4847568: malloc (vg_replace_malloc.c:299)
==26394==   by 0x1048B: main (forget_free.c:5)
*****
```

5. Nothing happens.

```
==26677== Invalid write of size 4
==26677==   at 0x1049C: main (size_100.c:6)
==26677== Address 0x49c61b8 is 248 bytes inside an unallocated block of size 4,194,088 in
arena "client"
*****
```

`sizeof(int)` is 4 here, so the length of `data` should be 25 instead of 100.

6. It runs.

```
*****
==26852== Invalid read of size 4
==26852==   at 0x104D0: main (free_then_print.c:8)
==26852== Address 0x49c6028 is 0 bytes inside a block of size 100 free'd
==26852==   at 0x4848B8C: free (vg_replace_malloc.c:530)
==26852==   by 0x104CB: main (free_then_print.c:6)
==26852== Block was alloc'd at
==26852==   at 0x4847568: malloc (vg_replace_malloc.c:299)
==26852==   by 0x104BB: main (free_then_print.c:5)
*****
```

7. *****

```
$ ./free_then_print.out
free(): invalid pointer
[1] 29093 abort (core dumped) ./free_then_print.out
*****
```

```
*****
==29041== Invalid free() / delete / delete[] / realloc()
==29041==   at 0x4C30D3B: free (in /usr/lib/valgrind/vgpreload_memcheck-amd64-linux.so)
==29041==   by 0x108706: main (free_then_print.c:7)
==29041== Address 0x522d044 is 4 bytes inside a block of size 100 alloc'd
==29041==   at 0x4C2FB0F: malloc (in /usr/lib/valgrind/vgpreload_memcheck-amd64-
linux.so)
==29041==   by 0x1086F2: main (free_then_print.c:5)
*****
```

8. [Dynamic array - Wikipedia](https://en.wikipedia.org/wiki/Dynamic_array#Performance)