

# پاسخ تمرین شماره ۵ درس معماری کامپیوتر

## نصب و راه اندازی gem5

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۹۶۱۱۰۳۲۳

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### مستندات نصب

چون از قبل این پیش نیازها نصب شده است نتیجه دستورات به صورت زیر است :

```
asay@ubuntu:~$ sudo apt-get install build-essential
Reading package lists... Done
Building dependency tree
Reading state information... Done
build-essential is already the newest version (12.1ubuntu2).
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.

asay@ubuntu:~$ sudo apt-get install git
Reading package lists... Done
Building dependency tree
Reading state information... Done
git is already the newest version (1:2.7.4-0ubuntu1.6).
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.

asay@ubuntu:~$ sudo apt-get install libgoogle-perftools-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
libgoogle-perftools-dev is already the newest version (2.4-0ubuntu5.16.04.1).
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.

asay@ubuntu:~$ sudo apt-get install protobuf-compiler
Reading package lists... Done
Building dependency tree
Reading state information... Done
protobuf-compiler is already the newest version (2.6.1-1.3).
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.

asay@ubuntu:~$ sudo apt-get install libprotobuf-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
libprotobuf-dev is already the newest version (2.6.1-1.3).
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.
```

```
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.  
asay@ubuntu:~$ sudo apt-get install m4  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
m4 is already the newest version (1.4.17-5).  
m4 set to manually installed.  
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.  
asay@ubuntu:~$ sudo apt-get install python  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
python is already the newest version (2.7.12-1~16.04).  
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.  
asay@ubuntu:~$ sudo apt-get install python-dev  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
python-dev is already the newest version (2.7.12-1~16.04).  
python-dev set to manually installed.  
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.  
asay@ubuntu:~$ sudo apt-get install scons  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
scons is already the newest version (2.4.1-1).  
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.  
asay@ubuntu:~$ sudo apt-get install zlib1g  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
zlib1g is already the newest version (1:1.2.8.dfsg-2ubuntu4.1).  
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.  
asay@ubuntu:~$ sudo apt-get install zlib1g-dev  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
zlib1g-dev is already the newest version (1:1.2.8.dfsg-2ubuntu4.1).  
zlib1g-dev set to manually installed.  
0 upgraded, 0 newly installed, 0 to remove and 538 not upgraded.
```

## نصب gem5 با فرض استفاده از معماری x86

### GIT CLONE

```
asay@ubuntu:~$ git clone https://gem5.googlesource.com/public/gem5  
Cloning into 'gem5'...  
remote: Sending approximately 170.80 MiB ...  
remote: Counting objects: 16, done  
remote: Finding sources: 100% (16/16)  
remote: Total 195298 (delta 149853), reused 195295 (delta 149853)  
Receiving objects: 100% (195298/195298), 170.82 MiB | 705.00 KiB/s, done.  
Resolving deltas: 100% (149853/149853), done.  
Checking connectivity... done.
```

## BUILD

```
asay@ubuntu:~/gem5$ scans build/x86/gem5.opt -j5
scans: Reading Scons script files...
Info: Using Python config: /usr/bin/python2.7-config
      support incremental linking and lto at the same time, so lto is being disabled. To force lto on anyway, use the --force-lto option. That will disable partial linking.
[SO PyBind] Checking for C library python.h... (cached) yes
[SO PyBind] Checking for C library python2.7... (cached) yes
[SO PyBind] Checking for C library pthread... (cached) yes
[SO PyBind] Checking for C library stdc++... (cached) yes
[SO PyBind] Checking for C library util... (cached) yes
[SO PyBind] Checking for accept(0,0) in C++ library None... (cached) yes
[SO PyBind] Checking for zlibVersion() in C++ library z... (cached) yes
[SO PyBind] Checking for GOOGLE_PROTOBUF_VERIFY_VERSION in c++ library protobuf... (cached) yes
[SO PyBind] Checking for C header file valgrind/valgrind.h... (cached) no
[SO PyBind] Checking for C header file valgrind/valgrind.h... (cached) yes
[SO PyBind] Checking for timer_create(CLOCK_MONOTONIC, NULL, NULL) in C library None... (cached) no
[SO PyBind] Checking for timer_create(CLOCK_MONOTONIC, NULL, NULL) in C library rt... (cached) yes
[SO PyBind] Checking for char temp; backtrace_symbols_fd(void*)temp, 0, 0) in C library None... (cached) yes
[SO PyBind] Checking for C header file fenv.h... (cached) yes
[SO PyBind] Checking for C header file png.h... (cached) no
Warning: Header file <png.h> not found.
      This host has no libpng library.
      Disabling support for PNG framebuffers.
[SO PyBind] Checking for C header file linux/kvm.h... (cached) yes
[SO PyBind] Checking size of struct kvm_xssave ... (cached) yes
[SO PyBind] Checking whether __i386__ is declared... (cached) yes
[SO PyBind] Checking whether __x86_64__ is declared... (cached) yes
Building in /home/asay/gem5/build/X86
Using saved variables file /home/asay/gem5/build/variables/X86
scans: Building targets ...
[SO PyBind] X86/python/_m5/param_Gem5ToTlmBridge32.cc --> .
[SO PyBind] X86/python/_m5/param_Gem5ToTlmBridge64.cc --> .
[SO PyBind] X86/python/_m5/param_Gem5ToTlmBridgeBase.cc --> .
[SO PyBind] HMCController --> X86/python/_m5/param_HMCController.cc
[SO PyBind] HelloObject --> X86/python/_m5/param_HelloObject.cc
[SO PARAM] HMCController --> X86/params/HMCController.hh
[SO PARAM] HelloObject --> X86/params/HelloObject.hh
[SO PyBind] I2CBus --> X86/python/_m5/param_I2CBus.cc
[SO PyBind] I2CDevice --> X86/params/I2CDevice.hh
[SO PyBind] I2CDriver --> X86/python/_m5/param_I2CDriver.cc
[SO PyBind] I2CDevice --> X86/python/_m5/param_I2CDevice.cc
[SO PyBind] I8042 --> X86/python/_m5/param_I8042.cc
[SO PARAM] I8042 --> X86/params/I8042.hh
[SO PyBind] PS2Device --> X86/params/PS2Device.hh
[SO PyBind] I82094AA --> X86/python/_m5/param_I82094AA.cc
[SO PARAM] I82094AA --> X86/params/I82094AA.hh
[SO PARAM] I8259 --> X86/params/I8259.hh
[SO PyBind] I8237 --> X86/python/_m5/param_I8237.cc
[SO PARAM] I8237 --> X86/params/I8237.hh
[SO PyBind] I8254 --> X86/python/_m5/param_I8254.cc
[SO PARAM] I8254 --> X86/params/I8254.hh
[TRACING] --> X86/debug/Intel8254Timer.hh
[SO PyBind] IGBE --> X86/python/_m5/param_IGBE.cc
[SO PARAM] IGBE --> X86/params/IGBE.hh
[TRACING] --> X86/debug/EthernetDesc.hh
[TRACING] --> X86/debug/EthernetIntr.hh

asay@ubuntu:~/gem5$
```

```

asay@ubuntu:~/gem5
[SO PARAM] IdeController -> X86/params/IdeController.hh
[SO PARAM] IdeDisk -> X86/params/IdeDisk.hh
[ CXX] X86/python/_m5/param_IdeController.cc -> .o
[SO PyBind] IdeDisk -> X86/python/_m5/param_IdeDisk.cc
[ CXX] X86/python/_m5/param_IdeDisk.cc -> .o
[SO PyBind] IndirectMemoryPrefetcher -> X86/python/_m5/param_IndirectMemoryPrefetcher.cc
[SO PARAM] IndirectMemoryPrefetcher -> X86/params/IndirectMemoryPrefetcher.hh
[ CXX] X86/python/_m5/param_IndirectMemoryPrefetcher.cc -> .o
[SO PyBind] IndirectPredictor -> X86/python/_m5/param_IndirectPredictor.cc
[ CXX] X86/python/_m5/param_IndirectPredictor.cc -> .o
[SO PyBind] InstTracer -> X86/python/_m5/param_InstTracer.cc
[ CXX] X86/python/_m5/param_InstTracer.cc -> .o
[SO PyBind] IntelTrace -> X86/python/_m5/param_IntelTrace.cc
[SO PARAM] IntelTrace -> X86/params/intelTrace.hh
[ CXX] X86/python/_m5/param_intelTrace.cc -> .o
[SO PyBind] IntrControl -> X86/python/_m5/param_IntrControl.cc
[ CXX] X86/python/_m5/param_IntrControl.cc -> .o
[SO PyBind] InvalidateGenerator -> X86/python/_m5/param_InvalidateGenerator.cc
[SO PARAM] InvalidateGenerator -> X86/params/InvalidateGenerator.hh
[ CXX] X86/python/_m5/param_InvalidateGenerator.cc -> .o
[SO PyBind] IrregularStreamBufferPrefetcher -> X86/python/_m5/param_IrregularStreamBufferPrefetcher.cc
[SO PARAM] IrregularStreamBufferPrefetcher -> X86/params/IrregularStreamBufferPrefetcher.hh
[ CXX] X86/python/_m5/param_IrregularStreamBufferPrefetcher.cc -> .o
[SO PyBind] IsaFake -> X86/python/_m5/param_IsaFake.cc
[SO PARAM] IsaFake -> X86/params/IsaFake.hh
[ CXX] X86/python/_m5/param_IsaFake.cc -> .o
[SO PyBind] KvmVM -> X86/python/_m5/param_KvmVM.cc
[ CXX] X86/python/_m5/param_KvmVM.cc -> .o
[SO PyBind] L1Cache_Controller -> X86/python/_m5/param_L1Cache_Controller.cc
[SO PARAM] L1Cache_Controller -> X86/params/L1Cache_Controller.hh
[ CXX] X86/python/_m5/param_L1Cache_Controller.cc -> .o
[SO PyBind] LFURP -> X86/python/_m5/param_LFURP.cc
[SO PARAM] LFURP -> X86/params/LFURP.hh
[ CXX] X86/python/_m5/param_LFURP.cc -> .o
[SO PyBind] LRURP -> X86/python/_m5/param_LRURP.cc
[ CXX] X86/python/_m5/param_LRURP.cc -> .o
[SO PyBind] LRUReplacementPolicy -> X86/python/_m5/param_LRUReplacementPolicy.cc
[SO PARAM] LRUReplacementPolicy -> X86/params/LRUReplacementPolicy.hh
[ CXX] X86/python/_m5/param_LRUReplacementPolicy.cc -> .o
[SO PyBind] LTAGE -> X86/python/_m5/param_LTAGE.cc
[SO PARAM] LTAGE -> X86/params/LTAGE.hh
[SO PARAM] TAGE -> X86/params/TAGE.hh
[SO PARAM] TAGEBase -> X86/params/TAGEBase.hh
[SO PARAM] LoopPredictor -> X86/params/LoopPredictor.hh
[ CXX] X86/python/_m5/param_LTAGE.cc -> .o
[SO PyBind] LinuxX86System -> X86/python/_m5/param_LinuxX86System.cc
[SO PARAM] LinuxX86System -> X86/params/LinuxX86System.hh
[SO PARAM] X86E820Entry -> X86/params/X86E820Entry.hh
[SO PARAM] X86E820Table -> X86/params/X86E820Table.hh
[ CXX] X86/python/_m5/param_LinuxX86System.cc -> .o
[SO PyBind] LocalBP -> X86/python/_m5/param_LocalBP.cc
[SO PARAM] LocalBP -> X86/params/LocalBP.hh
[ CXX] X86/python/_m5/param_LocalBP.cc -> .o
[SO PyBind] LoopPredictor -> X86/python/_m5/param_LoopPredictor.cc
[ CXX] X86/python/_m5/param_LoopPredictor.cc -> .o
[SO PyBind] MRURP -> X86/python/_m5/param_MRURP.cc
[SO PARAM] MRURP -> X86/params/MRURP.hh
[ CXX] X86/python/_m5/param_MRURP.cc -> .o
[SO PyBind] MathExprPowerModel -> X86/python/_m5/param_MathExprPowerModel.cc
[SO PARAM] MathExprPowerModel -> X86/params/MathExprPowerModel.hh
[ CXX] X86/python/_m5/param_MathExprPowerModel.cc -> .o
[SO PyBind] MemChecker -> X86/python/_m5/param_MemChecker.cc
[SO PARAM] MemChecker -> X86/params/MemChecker.hh
[ TRACING] -> X86/debug/MemChecker.hh
[ CXX] X86/python/_m5/param_MemChecker.cc -> .o
[SO PyBind] MemCheckerMonitor -> X86/python/_m5/param_MemCheckerMonitor.cc
[SO PARAM] MemCheckerMonitor -> X86/params/MemCheckerMonitor.hh
[ CXX] X86/python/_m5/param_MemCheckerMonitor.cc -> .o

```

```
asay@ubuntu:~/gem5
```

```
[      LINK] -> X86/base/vnc/lib.o.partial
[      TRACING] -> X86/debug/RubySequencer.hh
[      CXX] X86/mem/ruby/system/Sequencer.cc -> .o
[      CXX] X86/mem/ruby/system/WeightedLRUPolicy.cc -> .o
[      CXX] X86/mem/probes/base.cc -> .o
[      CXX] X86/mem/probes/stack_dist.cc -> .o
[      CXX] X86/mem/probes/mem_footprint.cc -> .o
[      CXX] X86/mem/probes/mem_trace.cc -> .o
[      TRACING] -> X86/debug/PciDevice.hh
[      CXX] X86/dev/pci/device.cc -> .o
[      LINK] -> X86/mem/ruby/system/lib.o.partial
[      TRACING] -> X86/debug/PciHost.hh
[      CXX] X86/dev/pci/host.cc -> .o
[      TRACING] -> X86/debug/DMACopyEngine.hh
[      CXX] X86/dev/pci/copy_engine.cc -> .o
[      CXX] X86/arch/x86/bios/e820.cc -> .o
[      LINK] -> X86/mem/probes/lib.o.partial
[      CXX] X86/arch/x86/bios/smbios.cc -> .o
[      CXX] X86/arch/x86/bios/intelmp.cc -> .o
[      CXX] X86/arch/x86/bios/acpi.cc -> .o
[      TRACING] -> X86/debug/PS2.hh
[      CXX] X86/dev/ps2/device.cc -> .o
[      CXX] X86/dev/ps2/keyboard.cc -> .o
[      CXX] X86/dev/ps2/mouse.cc -> .o
[      LINK] -> X86/arch/x86/bios/lib.o.partial
[      CXX] X86/dev/ps2/touchkit.cc -> .o
[      LINK] -> X86/dev/pci/lib.o.partial
[      CXX] X86/dev/ps2/types.cc -> .o
[      CXX] X86/systemc/dt/misc/sc_concatref.cc -> .o
[      CXX] X86/systemc/dt/misc/sc_value_base.cc -> .o
[      CXX] X86/systemc/tlm_core/2/generic_payload/gp.cc -> .o
[      CXX] X86/systemc/tlm_core/2/generic_payload/phase.cc -> .o
[      LINK] -> X86/dev/ps2/lib.o.partial
[      CXX] X86/proto/protoio.cc -> .o
[      CXX] X86/sim/arguments.cc -> .o
[      LINK] -> X86/systemc/dt/misc/lib.o.partial
[      CXX] X86/sim/async.cc -> .o
[      CXX] X86/sim/backtrace_glibc.cc -> .o
[      CXX] X86/sim/core.cc -> .o
[VER TAGS] -> X86/sim/tags.cc
[      CXX] X86/sim/tags.cc -> .o
[      LINK] -> X86/systemc/tlm_core/2/generic_payload/lib.o.partial
[      CXX] X86/sim/cxx_config.cc -> .o
[      LINK] -> X86/proto/lib.o.partial
[      TRACING] -> X86/debug/CxxConfig.hh
[      CXX] X86/sim/cxx_manager.cc -> .o
[      CXX] X86/sim/cxx_config_intl.cc -> .o
[      CXX] X86/sim/debug.cc -> .o
[      CXX] X86/sim/py_interact.cc -> .o
[      CXX] X86/sim/eventq.cc -> .o
[      CXX] X86/sim/global_event.cc -> .o
[CONFIG H] HAVE_PROTOBUF, 1 -> X86/config/have_protobuf.hh
[      CXX] X86/sim/init.cc -> .o
[      CXX] X86/sim/init_signals.cc -> .o
[      CXX] X86/sim/port.cc -> .o
[      CXX] X86/sim/python.cc -> .o
[      CXX] X86/sim/redirect_path.cc -> .o
[      TRACING] -> X86/debug/TimeSync.hh
[      CXX] X86/sim/root.cc -> .o
[      CXX] X86/sim/serialize.cc -> .o
[      CXX] X86/sim/drain.cc -> .o
[      CXX] X86/sim/sim_events.cc -> .o
[      CXX] X86/sim/sim_object.cc -> .o
[      CXX] X86/sim/sub_system.cc -> .o
[      CXX] X86/sim/ticked_object.cc -> .o
[      CXX] X86/sim/simulate.cc -> .o
[      CXX] X86/sim/stat_control.cc -> .o
[      CXX] X86/sim/stat_register.cc -> .o
```

```
asay@ubuntu:~/gem5$ [ TRACING ] -> X86/debug/VoltageDomain.hh
[   CXxx] X86/sim/voltage_domain.cc -> .o
[   CXxx] X86/sim/se_signal.cc -> .o
[   CXxx] X86/sim/linear_solver.cc -> .o
[ GENERATE] x86 -> X86/arch/remote_gdb.hh
[ CONFIG H] USE_KVM, 1 -> X86/config/use_kvm.hh
[ TRACING ] -> X86/debug/WorkItems.hh
[   CXxx] X86/sim/system.cc -> .o
[   CXxx] X86/sim/dvfs_handler.cc -> .o
[   CXxx] X86/sim/clocked_object.cc -> .o
[   CXxx] X86/sim/mathexpr.cc -> .o
[ TRACING ] -> X86/debug/Fault.hh
[   CXxx] X86/sim/faults.cc -> .o
[   CXxx] X86/sim/process.cc -> .o
[   CXxx] X86/sim/fd_array.cc -> .o
[   CXxx] X86/sim/fd_entry.cc -> .o
[ GENERATE] x86 -> X86/arch/pseudo_inst.hh
[   CXxx] X86/sim/pseudo_inst.cc -> .o
[   CXxx] X86/sim/syscall_emul.cc -> .o
[   CXxx] X86/sim/syscall_desc.cc -> .o
[ TRACING ] -> X86/debug/DynInst.hh
[ TRACING ] -> X86/debug/IQ.hh
[   CXxx] X86/cpu/o3/base_dyn_inst.cc -> .o
[ TRACING ] -> X86/debug/Activity.hh
[ TRACING ] -> X86/debug/Commit.hh
[ TRACING ] -> X86/debug/CommitRate.hh
[ TRACING ] -> X86/debug/O3PipeView.hh
[   CXxx] X86/cpu/o3/commit.cc -> .o
[ GENERATE] x86 -> X86/arch/kernel_stats.hh
[ TRACING ] -> X86/debug/O3CPU.hh
[   CXxx] X86/cpu/o3/cpu.cc -> .o
[   CXxx] X86/cpu/o3/deriv.cc -> .o
[ LINK] -> X86/sim/lib.o.partial
[   CXxx] X86/cpu/o3/decode.cc -> .o
[   CXxx] X86/cpu/o3/dyn_inst.cc -> .o
[   CXxx] X86/cpu/o3/fetch.cc -> .o
[   CXxx] X86/cpu/o3/free_list.cc -> .o
[   CXxx] X86/cpu/o3/fu_pool.cc -> .o
[   CXxx] X86/cpu/o3/iew.cc -> .o
[   CXxx] X86/cpu/o3/inst_queue.cc -> .o
[ TRACING ] -> X86/debug/LSQ.hh
[ TRACING ] -> X86/debug/Writback.hh
[   CXxx] X86/cpu/o3/lsq.cc -> .o
[   CXxx] X86/cpu/o3/lsq_unit.cc -> .o
^[[17~ [   CXxx] X86/cpu/o3/mem_dep_unit.cc -> .o
[   CXxx] X86/cpu/o3/regfile.cc -> .o
[ TRACING ] -> X86/debug/Rename.hh
[   CXxx] X86/cpu/o3/rename.cc -> .o
[   CXxx] X86/cpu/o3/rename_map.cc -> .o
[ TRACING ] -> X86/debug/R0B.hh
[   CXxx] X86/cpu/o3/rob.cc -> .o
[   CXxx] X86/cpu/o3/scoreboard.cc -> .o
[ TRACING ] -> X86/debug/StoreSet.hh
[   CXxx] X86/cpu/o3/store_set.cc -> .o
[   CXxx] X86/cpu/o3/thread_context.cc -> .o
[   CXxx] X86/cpu/o3/checker.cc -> .o
[ TRACING ] -> X86/debug/CacheRepl.hh
[ TRACING ] -> X86/debug/CacheVerbose.hh
[   CXxx] X86/mem/cache/base.cc -> .o
[ TRACING ] -> X86/debug/CacheTags.hh
[   CXxx] X86/mem/cache/cache.cc -> .o
[   CXxx] X86/mem/cache/cache_blk.cc -> .o
[   CXxx] X86/mem/cache/mshr.cc -> .o
[   CXxx] X86/mem/cache/mshr_queue.cc -> .o
[ LINK] -> X86/cpu/o3/lib.o.partial
[   CXxx] X86/mem/cache/noncoherent_cache.cc -> .o
[   CXxx] X86/mem/cache/write_queue.cc -> .o
[   CXxx] X86/mem/cache/write_queue_entry.cc -> .o
```

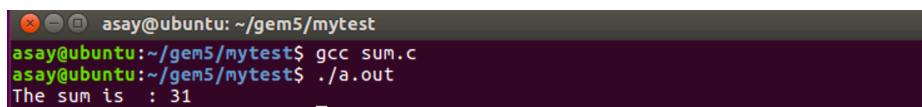
```
asay@ubuntu:~/gem5$ scons: done building targets.
```

## اجرای یک برنامه دلخواه

برای این بخش یک برنامه دو عدد را جمع می‌زند در نظر گرفته شده که فایل برنامه به پیوست ارسال می‌شود.  
ابتدا یک فایل به نام **mytest** با دستور

```
mkdi mytest
```

حال داخل فایل ساخته شده کد پیوست شده را داخل آن قرار می‌دهیم و بعد یک فایل اجرایی از آن می‌گیریم.

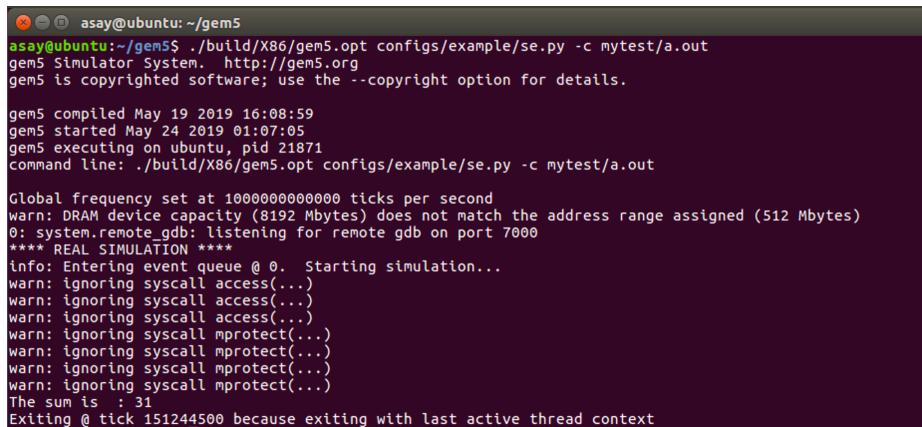


```
asay@ubuntu:~/gem5/mytest$ gcc sum.c
asay@ubuntu:~/gem5/mytest$ ./a.out
The sum is : 31
```

حال فایل **sum.c** را بر روی معماری x86 با دستور زیر اجرا می‌کنیم:

```
./build/X86/gem5.opt configs/example/se.py -c mytest/a.out
```

که نتیجه آن به شرح زیر می‌باشد:



```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:07:05
gem5 executing on ubuntu, pid 21871
command line: ./build/X86/gem5.opt configs/example/se.py -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 151244500 because exiting with last active thread context
```

که فایل **Stat.txt** به پیوست ارسال شده است.

## اجرا با cachesize ها و cacheline متفاوت

Cachesize = 1kb , cacheline : 16

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --lid_size 1kB --cacheline_size 16 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:12:11
gem5 executing on ubuntu, pid 22851
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --lid_size 1kB --cacheline_size 16 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 2341810500 because exiting with last active thread context
```

Cachesize = 1kb , cacheline : 32

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --lid_size 1kB --cacheline_size 32 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:13:04
gem5 executing on ubuntu, pid 23013
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --lid_size 1kB --cacheline_size 32 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 1619066000 because exiting with last active thread context
```

### Cachesize = 1kb , cacheline : 64

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 1kB --cacheline_size 64 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:13:42
gem5 executing on ubuntu, pid 23130
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 1kB --cacheline_size 64 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 1177492000 because exiting with last active thread context
```

### Cachesize = 8kb , cacheline : 16

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 8kB --cacheline_size 16 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:25:15
gem5 executing on ubuntu, pid 25268
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 8kB --cacheline_size 16 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 1149174000 because exiting with last active thread context
```

## Cachesize = 8kb , cacheline : 32

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --lid_size 8kB --cacheline_size 32 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:26:26
gem5 executing on ubuntu, pid 25481
Command line: ./build/X86/gem5.opt configs/example/se.py --ruby --lid_size 8kB --cacheline_size 32 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 795628500 because exiting with last active thread context
```

## Cachesize = 8kb , cacheline : 64

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --lid_size 8kB --cacheline_size 64 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:27:48
gem5 executing on ubuntu, pid 25734
Command line: ./build/X86/gem5.opt configs/example/se.py --ruby --lid_size 8kB --cacheline_size 64 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 600548500 because exiting with last active thread context
```

## Cachesize = 16kb , cacheline : 16

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 16kB --cacheline_size 16 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:28:41
gem5 executing on ubuntu, pid 25897
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 16kB --cacheline_size 16 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 1003328000 because exiting with last active thread context
```

## Cachesize = 16kb , cacheline : 32

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 16kB --cacheline_size 32 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:29:52
gem5 executing on ubuntu, pid 26120
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 16kB --cacheline_size 32 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 684134500 because exiting with last active thread context
```

## Cachesize = 16kb , cacheline : 64

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 16kB --cacheline_size 64 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:31:27
gem5 executing on ubuntu, pid 26411
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 16kB --cacheline_size 64 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 520410500 because exiting with last active thread context
```

## Cachesize = 32kb , cacheline : 16

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 16kB --cacheline_size 64 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:31:27
gem5 executing on ubuntu, pid 26411
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 16kB --cacheline_size 64 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 520410500 because exiting with last active thread context
```

## Cachesize = 32kb , cacheline : 32

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 32kB --cacheline_size 32 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:33:58
gem5 executing on ubuntu, pid 26886
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 32kB --cacheline_size 32 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 655065500 because exiting with last active thread context
```

## Cachesize = 32kb , cacheline : 64

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 32kB --cacheline_size 32 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:33:58
gem5 executing on ubuntu, pid 26886
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 32kB --cacheline_size 32 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 655065500 because exiting with last active thread context
```

## Cachesize = 64kb , cacheline : 16

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 64kB --cacheline_size 16 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:36:30
gem5 executing on ubuntu, pid 27346
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 64kB --cacheline_size 16 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 938062500 because exiting with last active thread context
```

## Cachesize = 64kb , cacheline : 32

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 64kB --cacheline_size 32 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:37:34
gem5 executing on ubuntu, pid 27544
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 64kB --cacheline_size 32 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 632089000 because exiting with last active thread context
```

## Cachesize = 64kb , cacheline : 64

```
asay@ubuntu:~/gem5$ ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 64kB --cacheline_size 64 -c mytest/a.out
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 compiled May 19 2019 16:08:59
gem5 started May 24 2019 01:39:25
gem5 executing on ubuntu, pid 27888
command line: ./build/X86/gem5.opt configs/example/se.py --ruby --l1d_size 64kB --cacheline_size 64 -c mytest/a.out

Global frequency set at 100000000000 ticks per second
warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
warn: Replacement policy updates recently became the responsibility of SLICC state machines. Make sure to
setMRU() near callbacks in .sm files!
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall access(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
warn: ignoring syscall mprotect(...)
The sum is : 31
Exiting @ tick 469849000 because exiting with last active thread context
```