Bit Manipulation

System Programming Recitation

2020.04.08

SUNG KYUN KWAN UNIVERSITY

Programming Homework

- Bit manipulation
  - Solve a series of programming “puzzles”
  - Due date : 2020-4-17 (Friday) 11:59 PM
  - You can submit a zip file
- Please note the several instructions before programming
  - Using only straightline code (no loop or conditionals)
  - You are only allowed to use the eight operators
    - ! ~ & ^ | + << >>
- You should work on a Linux machine

SUNG KYUN KWAN UNIVERSITY

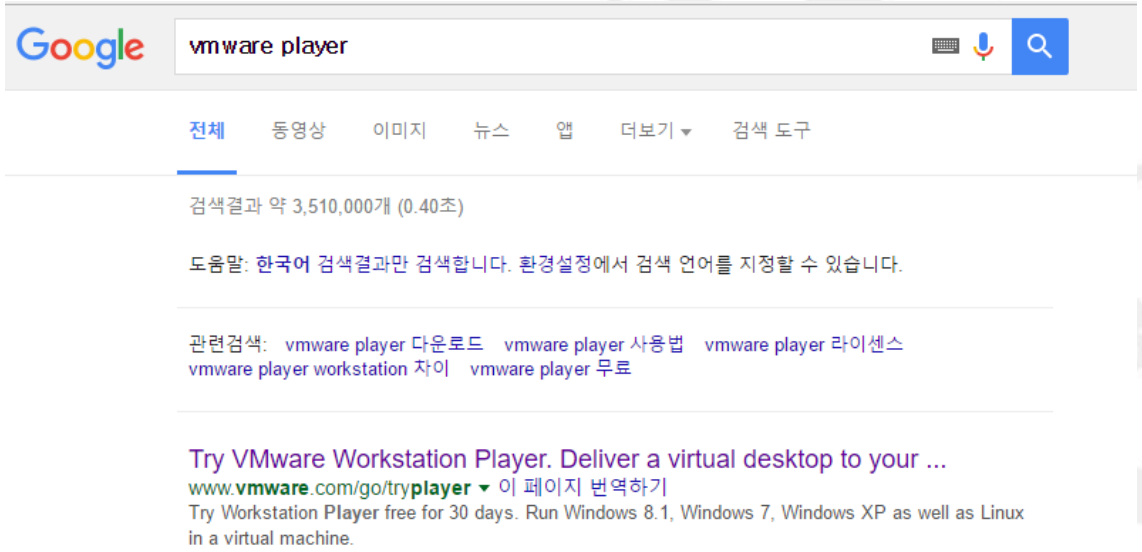
Install Linux System

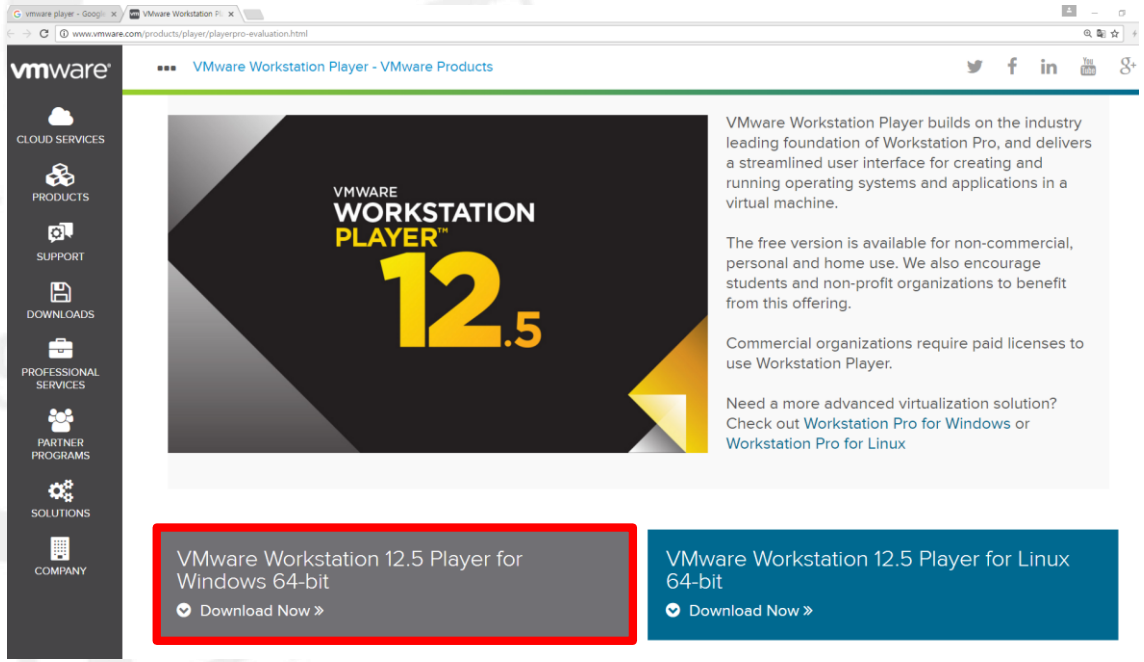
1

SUNG KYUN KWAN UNIVERSITY

VMware Player

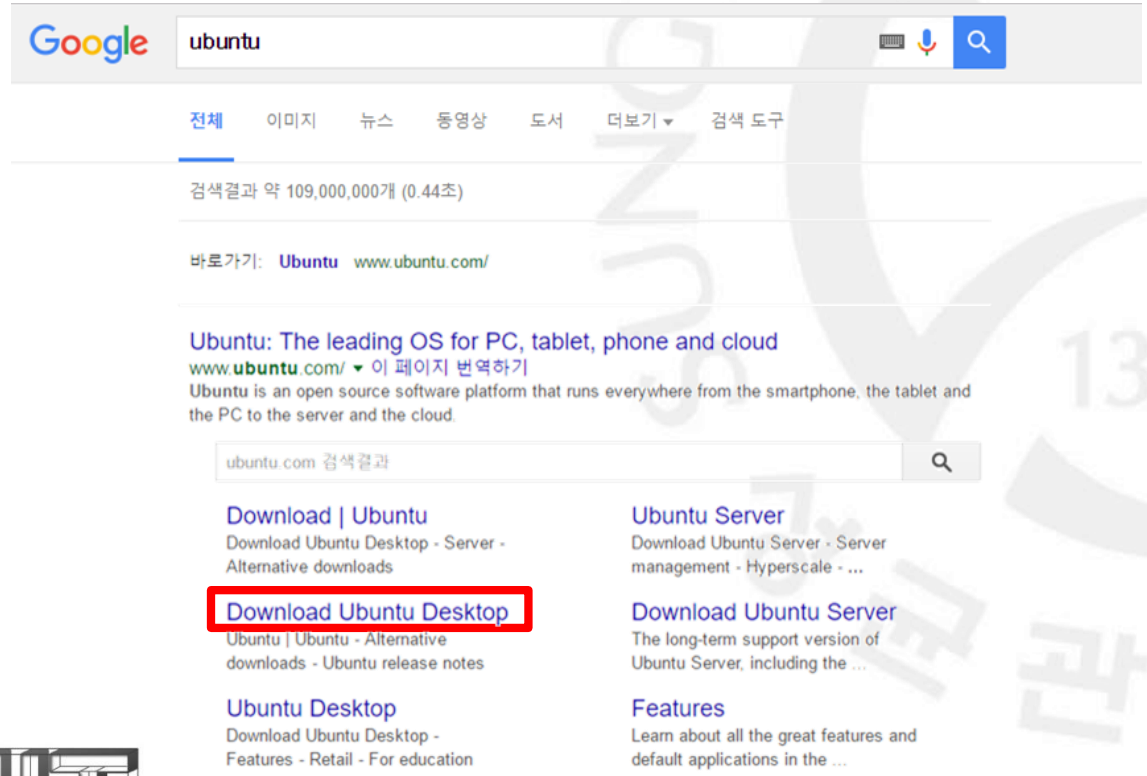
- http://www.vmware.com/products/player/playerpro-evaluation.html
- Desktop virtualization application for test-and-development environment

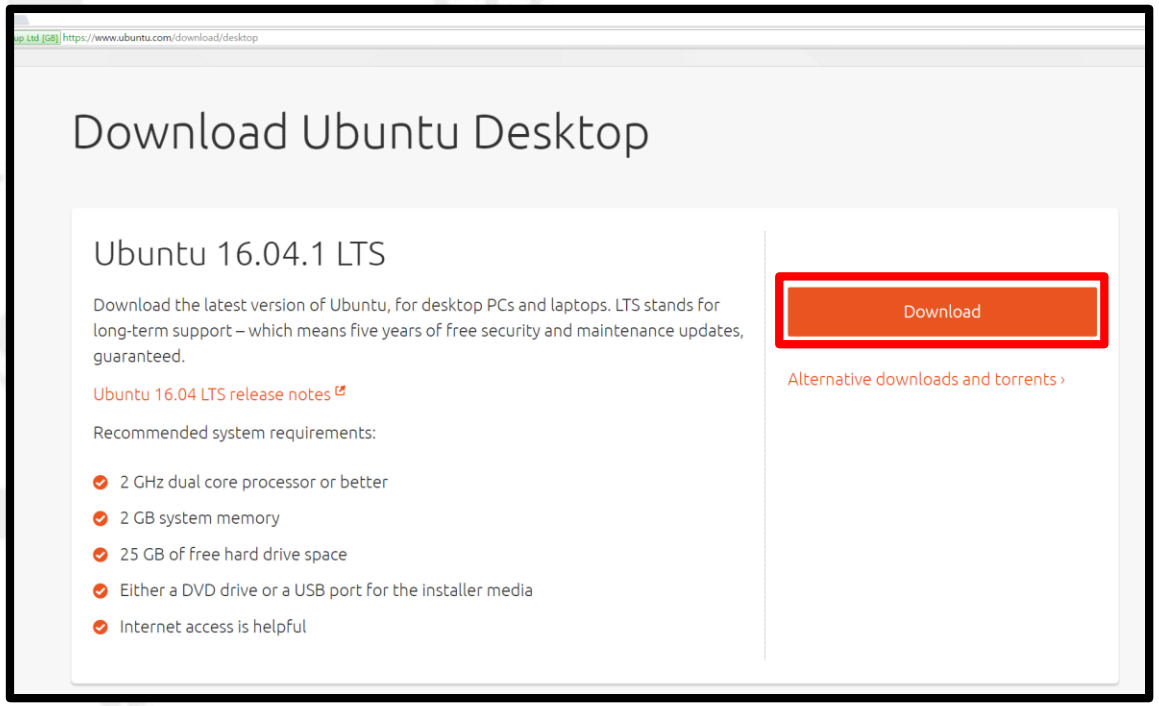




Ubuntu

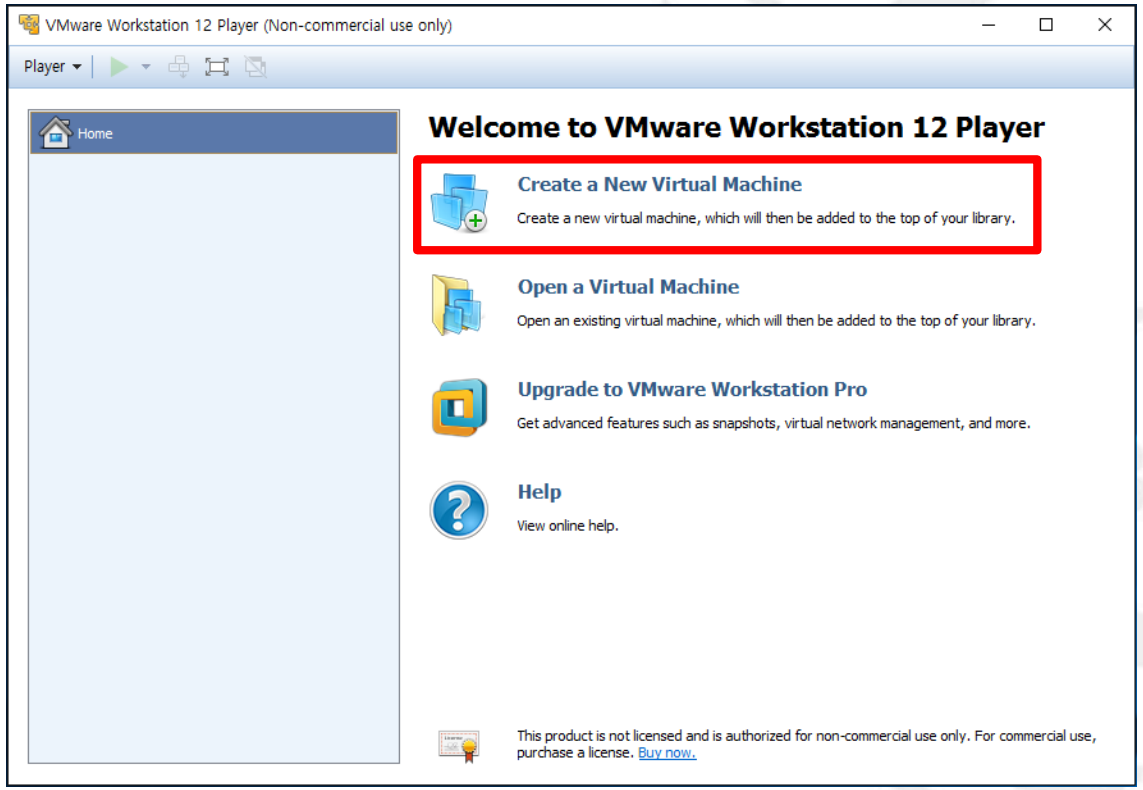
- https://www.ubuntu.com/download/desktop
- A Debian-based Linux operating system

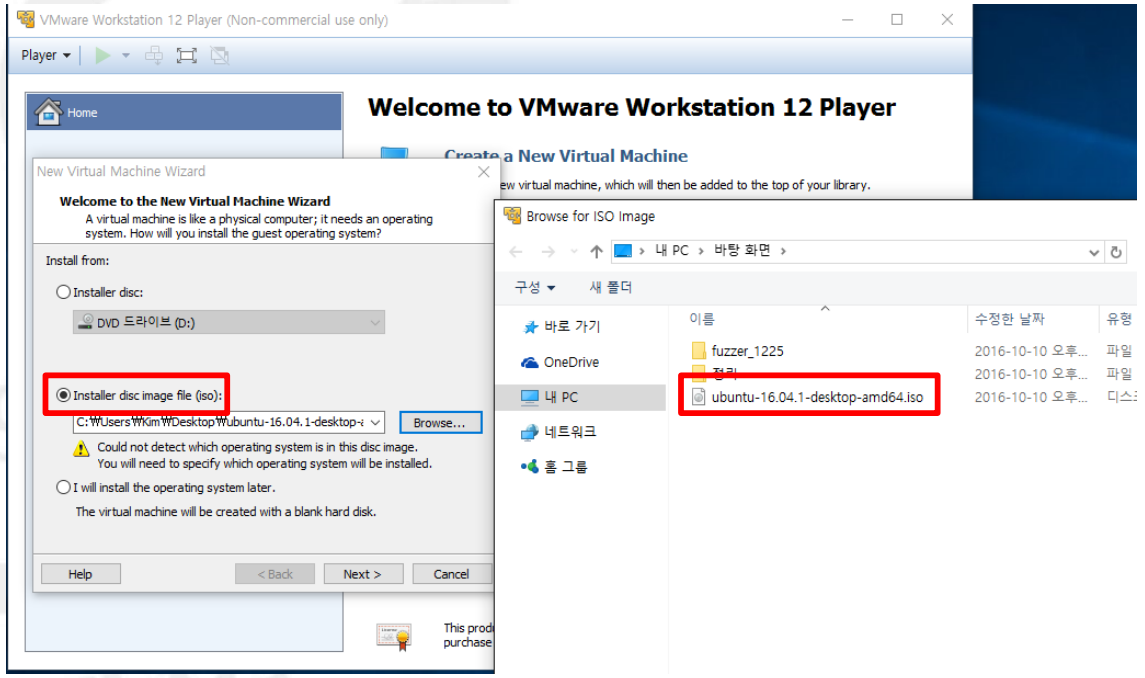




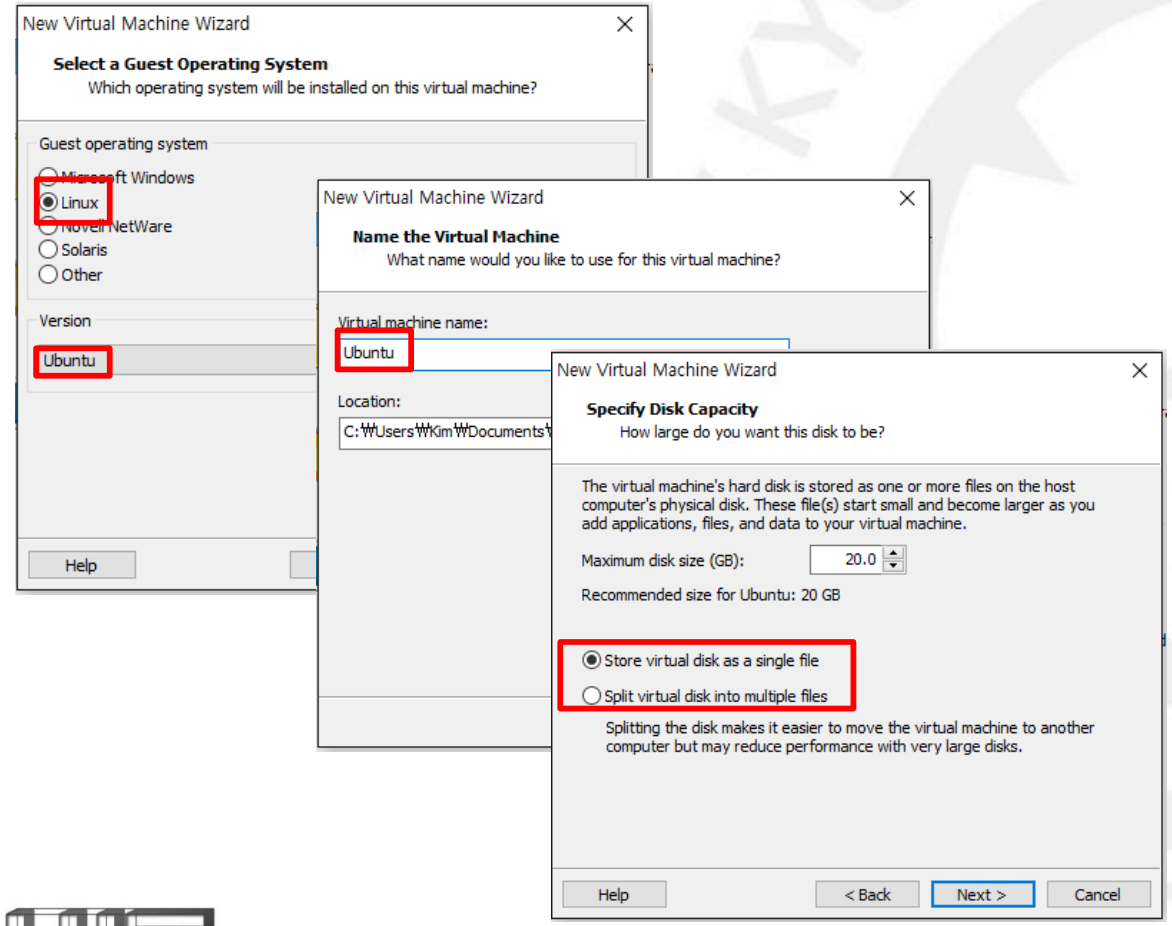
SUNG KYUN KWAN UNIVERSITY

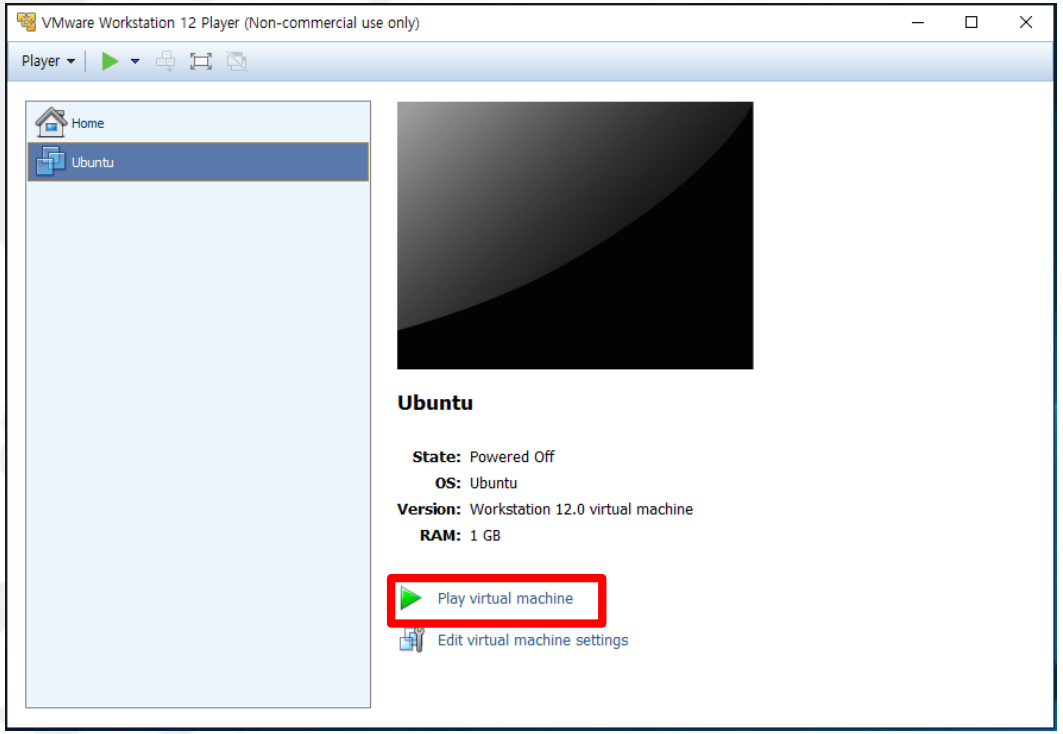
Install Ubuntu in VMware Player #1





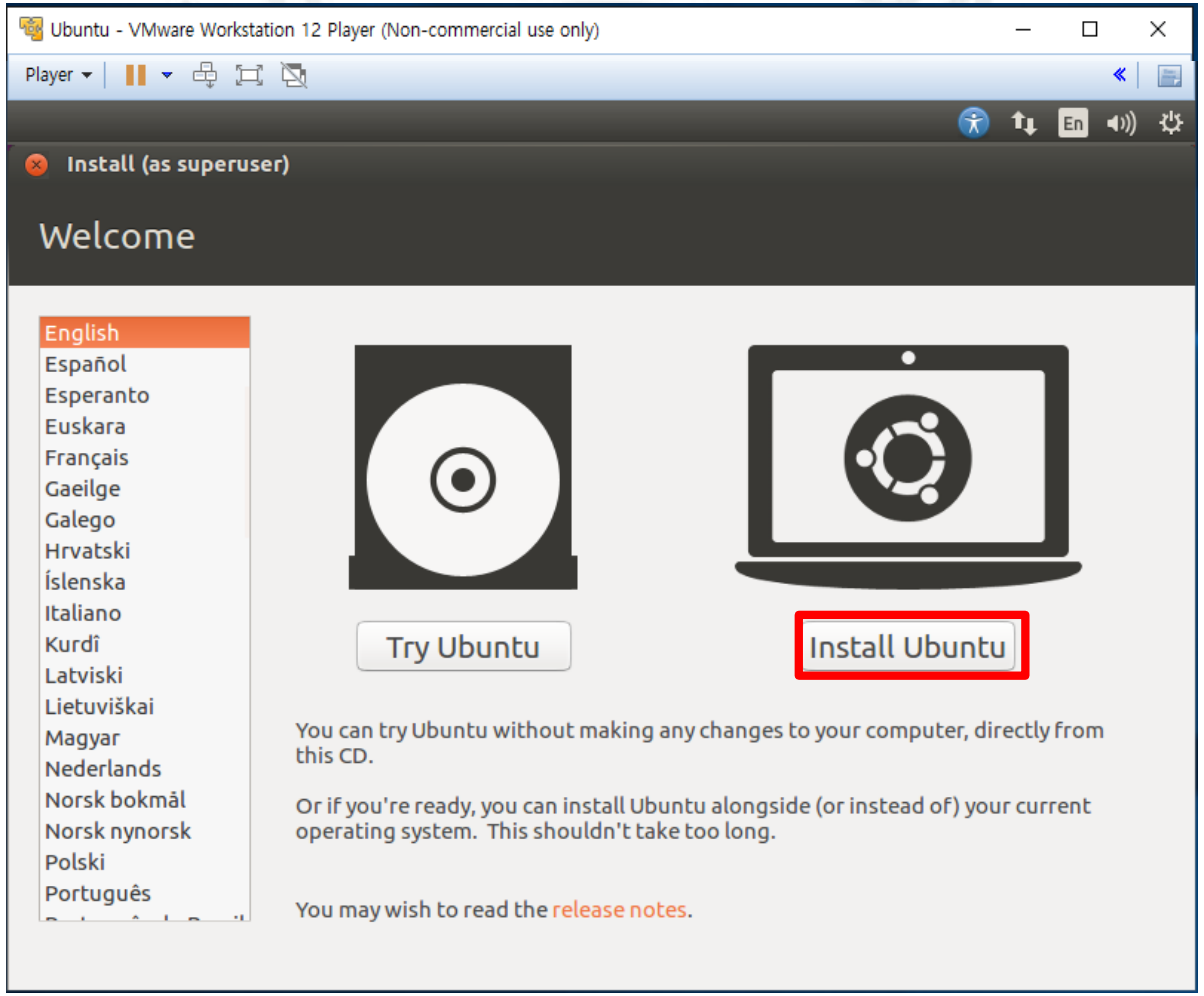
Install Ubuntu in VMware Player #2





SUNG KYUN KWAN UNIVERSITY

Install Ubuntu in VMware Player #3



Guide for Homework

2

SUNG KYUN KWAN UNIVERSITY

Handout Instructions

```
ejin@ubuntu: ~/Desktop/SP
ejin@ubuntu:~/Desktop/SP$ ls
sp_programming_hw1.zip
ejin@ubuntu:~/Desktop/SP$ unzip sp_programming_hw1.zip
Archive:  sp_programming_hw1.zip
  inflating: sp-programming-hw1.docx
  inflating: sp-programming-hw1.pdf
  inflating: sp-programming-hw1.tar
ejin@ubuntu:~/Desktop/SP$ tar xvf sp-programming-hw1.tar
datalab-handout/
datalab-handout/bits.c
datalab-handout/btest.c
datalab-handout/fshow.c
datalab-handout/bits.h
datalab-handout/README
datalab-handout/Makefile
datalab-handout/Driverhdrs.pm
datalab-handout/driver.pl
datalab-handout/dlc
datalab-handout/Driverlib.pm
datalab-handout/btest.h
datalab-handout/ishow.c
datalab-handout/decl.c
datalab-handout/tests.c
ejin@ubuntu:~/Desktop/SP$
```

```
ejin@ubuntu: ~/Desktop/SP/datalab-handout
ejin@ubuntu:~/Desktop/SP$ ls -al
total 2724
drwxrwxr-x  3 ejin ejin    4096 Oct 10 07:36 .
drwxr-xr-x 13 ejin ejin    4096 Oct 10 07:35 ..
drwxrwxr-x  2 ejin ejin    4096 Oct  4 03:30 datalab-handout
-rw-rw-r--  1 ejin ejin   37766 Oct  4 20:45 sp-programming-hw1.docx
-rw-rw-r--  1 ejin ejin  508016 Oct  4 20:47 sp-programming-hw1.pdf
-rw-rw-r--  1 ejin ejin 1310720 Oct  4 19:30 sp-programming-hw1.tar
-rw-rw-r--  1 ejin ejin  909892 Oct 10 07:33 sp_programming_hw1.zip
ejin@ubuntu:~/Desktop/SP$ cd datalab-handout/
ejin@ubuntu:~/Desktop/SP/datalab-handout$ ls -al
total 1300
drwxrwxr-x 2 ejin ejin    4096 Oct  4 03:30 .
drwxrwxr-x 3 ejin ejin    4096 Oct 10 07:36 ..
-rw-rw-r-- 1 ejin ejin    9382 Oct  4 03:30 bits.c
-rw-rw-r-- 1 ejin ejin    2285 Oct  4 03:30 bits.h
-rw-r--r-- 1 ejin ejin   15752 Sep 19  2012 btest.c
-rw-r--r-- 1 ejin ejin    1006 Sep 13  2010 btest.h
-rw-rw-r-- 1 ejin ejin    3253 Oct  4 03:30 decl.c
-rwxrwxr-x 1 ejin ejin 1234928 Oct  4 01:51 dlc
-rw-rw-r-- 1 ejin ejin     267 Oct  4 03:30 Driverhdrs.pm
-rw-r--r-- 1 ejin ejin    3630 May 23  2011 Driverlib.pm
-rwxr-xr-x 1 ejin ejin   11798 Apr 24  2012 driver.pl
-rw-r--r-- 1 ejin ejin    3009 Sep 13  2006 fshow.c
-rw-r--r-- 1 ejin ejin    1502 Sep 13  2006 ishow.c
-rw-r--r-- 1 ejin ejin     542 Nov  2  2010 Makefile
-rw-r--r-- 1 ejin ejin    4564 May 31  2011 README
-rw-rw-r-- 1 ejin ejin    4096 Oct  4 03:30 tests.c
ejin@ubuntu:~/Desktop/SP/datalab-handout$
```

SUNG KYUN KWAN UNIVERSITY

sys/cdefs.h

- You may meet this problem

```
hittest@ubuntu:~/Downloads/sp_programming_hw1/datalab-handout$ make
gcc -O -Wall -m32 -lm -o btest bits.c btest.c decl.c tests.c
In file included from /usr/include/stdio.h:27:0,
                 from btest.c:16:
/usr/include/features.h:374:25: fatal error: sys/cdefs.h: No such file or directory
```

- Solution
  - sudo apt-get install g++-multilib

```
ejin@ubuntu:~/Desktop/SP/datalab-handout$ sudo apt-get install g++-multilib
[sudo] password for ejin:
ejin@ubuntu:~/Desktop/SP/datalab-handout$ make
gcc -O -Wall -m32 -lm -o btest bits.c btest.c decl.c tests.c
btest.c: In function ‘main’:
btest.c:528:9: warning: variable ‘errors’ set but not used [-Wunused-but-set-var
iable]
     int errors;
         ^
gcc -O -Wall -m32 -o fshow fshow.c
gcc -O -Wall -m32 -o ishow ishow.c
```

SUNG KYUN KWAN UNIVERSITY

Autograding Your Work #1

- Before testing your work, please execute **make** instruction

```
ejin@ubuntu:~/Desktop/SP/datalab-handout$ make
gcc -O -Wall -m32 -lm -o btest bits.c btest.c decl.c tests.c
btest.c: In function 'main':
btest.c:528:9: warning: variable 'errors' set but not used [-
Wunused-but-set-variable]
     int errors;
         ^
gcc -O -Wall -m32 -o fshow fshow.c
gcc -O -Wall -m32 -o ishow ishow.c
```

- btest

```
ejin@ubuntu:~/Desktop/SP/datalab-handout$ ./btest
Score   Rating  Errors  Function
 3      3       0       addOK
 3      3       0       subOK
 3      3       0       logicalShift
 3      3       0       isGreater
 4      4       0       satAdd
 3      3       0       rempwr2
 4      4       0       bitCount
 2      2       0       byteSwap
 4      4       0       float_i2f
 4      4       0       float_twice
Total points: 33/33
ejin@ubuntu:~/Desktop/SP/datalab-handout$ ./btest -f addOK
Score   Rating  Errors  Function
 3      3       0       addOK
Total points: 3/3
ejin@ubuntu:~/Desktop/SP/datalab-handout$ ./btest -f subOK
Score   Rating  Errors  Function
 3      3       0       subOK
Total points: 3/3
ejin@ubuntu:~/Desktop/SP/datalab-handout$ ./btest -f addOK -1 0x80000000 0x800
00000
Score   Rating  Errors  Function
 3      3       0       addOK
Total points: 3/3
```

Autograding Your Work #2

- dlc

```
ejin@ubuntu:~/Desktop/SP/datalab-handout$ ./dlc bits.c
/usr/include/stdc-predef.h:1: Warning: Non-includable file <command-line> includ
ed from includable file /usr/include/stdc-predef.h.

Compilation Successful (1 warning)
ejin@ubuntu:~/Desktop/SP/datalab-handout$ ./dlc -e bits.c
/usr/include/stdc-predef.h:1: Warning: Non-includable file <command-line> includ
ed from includable file /usr/include/stdc-predef.h.
dlc:bits.c:181:addOK: 9 operators
dlc:bits.c:197:subOK: 12 operators
dlc:bits.c:215:logicalShift: 14 operators
dlc:bits.c:227:isGreater: 12 operators
dlc:bits.c:245:satAdd: 15 operators
dlc:bits.c:262:rempwr2: 11 operators
dlc:bits.c:286:bitCount: 25 operators
dlc:bits.c:306:byteSwap: 17 operators
dlc:bits.c:348:float_i2f: 27 operators
dlc:bits.c:382:float_twice: 15 operators

Compilation Successful (1 warning)
```

- driver.pl

```
ejin@ubuntu:~/Desktop/SP/datalab-handout$ ./driver.pl
5. Running './dlc -e' to get operator count of each function.

Correctness Results     Perf Results
Points  Rating  Errors  Points  Ops     Puzzle
3       3       0       2       9       addOK
3       3       0       2       12      subOK
3       3       0       2       14      logicalShift
3       3       0       2       12      isGreater
4       4       0       2       15      satAdd
3       3       0       2       11      rempwr2
4       4       0       2       25      bitCount
2       2       0       2       17      byteSwap
4       4       0       2       27      float_i2f
4       4       0       2       15      float_twice

Score = 53/53 [33/33 Corr + 20/20 Perf] (157 total operators)
```

Contact Us

- Email address
  - 김이진: ejin@o365.skku.edu
  - 이정호: dlwjdgh100@o365.skku.edu
- Lab.
  - 제 2공학관 27313호 (방문 전 연락필요)

SUNG KYUN KWAN UNIVERSITY