

Case Study for HitFox

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Dedication

For HitFox Company

Abstract

This document is a description of the tasks and steps I carried out to fulfil them. The introduction into designed classes for C++/python/Java is given. The three different language specifications are used to solve the given problems.

Table of Contents

1 Task A	3
1.1 Introduction to Taks A	3
1.2 Realization of Taks A	3
1.2.1 Task A in C++	4
1.2.2 Task A in Python	7
1.2.3 Task A installation in Python	18
2 Makefile - the way to build and install the projects	21
3 Task B	24
3.1 Introduction to Taks B	24
3.2 Realization of Taks B	25
4 Section Second	25
4.1 Bullet Lists	25
4.2 Enumerated Lists	26
4.3 Definition Lists	26
5 Section Third	26
5.1 Literal Blocks	26
5.2 Block Quotes	27
5.3 Tables	27
6 Section Fourth	27
6.1 Citations	27
7 Section Fifth	28
7.1 Targets	28
8 Section Sixth	28
8.1 More details	28
9 HOW-TO obtain different format from RST source	29
10 References	30

Note

The solution, presented here, are not optimal! Additional efforts can be requested to find better ways of solving the problems.

1 Task A

1.1 Introduction to Taks A

- Given is an unordered list of numbers (which can appear repeatedly), and we would like to generate a data structure which has the following structure:

```
DivisorsHash { key: 'number' => value: 'divisors of the number in the list' }
```

- Moreover, there some extra requirements.
 - Keys must be stored ordered in the data structure, in a way that when iterated over its keys they will be returned in an ordered manner.
 - List of values for each key must be ordered.

Example Input:
[7,4,2,10,3,6,4,5]

Example Output:

```
{
  2 => [1],
  3 => [1],
  4 => [1,2],
  5 => [1],
  6 => [1,2,3],
  7 => [1],
  10 => [1,2,5],
}
```

- Code the defined data structure and write an algorithm which, given a list of numbers, returns a filled instance of it. Tasks:
- Write class `DivisorsHash`
- Write `DivisorsHash generate(...)` method on class `ProblemA`

1.2 Realization of Taks A

First, we consider the C++ implementation. There are two classes:

- `class DivisorsHash` --> to store divisors of one key
- `class ProblemA` --> to generate a list of divisors for a list of keys

The method `std::vector<int> DivisorsHash::findDivisors ()` performs the finding for all divisors of any non-zero and positive integer `[divisors_in_c]`.

1.2.1 Task A in C++

cat include/DivisorsHash.h [\[code\]](#).

```
#include <string>
#include <iostream>
#include <vector>
#include <iostream>
#include <sstream>
#include <stdio.h>
#include <math.h>
#include <algorithm>

#ifndef DivisorsHash_H
#define DivisorsHash_H

bool wayToSortInt(int i, int j) { return i < j; }

class DivisorsHash {
public:

    /// ctor by default is empty
    DivisorsHash (): key(0){}

    ~DivisorsHash() {}

    void setKey (int i) { key=i; return; }
    int getKey () const { return key;}

    std::vector<int> findDivisors () {
        if (key<0) key*=-1;

        unsigned int keysqrt = (unsigned int) sqrt (key);
        for (unsigned int i=1; i<=keysqrt;i++ )
            if (key%i==0) { divisors.push_back(i);
                if (i>1 && i< key/i)
                    divisors.push_back(key/i); }

        std::sort(divisors.begin(),divisors.end(),wayToSortInt);
        return divisors;
    }

    std::vector<int> getDivisors() const { return divisors;}

    /// to print out the DivisorsHash
    friend std::ostream & operator <<(std::ostream & out,
```

```

        const DivisorsHash & right){

        std::stringstream ss;
        std::vector<int> Divisors = right.getDivisors();
        int Key = right.getKey();
        char str[100];
        sprintf(str, "%d => [", Key);
        std::string tmp = str;
        ss<<tmp;
        for (int i=0;i<Divisors.size()-1;i++)
        {
                sprintf(str,"%d,",Divisors[i]);
                tmp=str;
                ss<<tmp;
        }
        sprintf(str,"%d]",Divisors[Divisors.size()-1]);
        tmp=str;
        ss<<tmp;
        out<<ss.str();
    }

private:

    int key;
    std::vector<int> divisors;

};

#endif

```

```
cat include/ProblemA.h
```

```

#include <string>
#include <iostream>
#include <vector>
#include <iostream>
#include <sstream>
#include <stdio.h>
#include <algorithm>
#include "DivisorsHash.h"

#ifndef ProblemA_H
#define ProblemA_H

bool wayToSort(DivisorsHash i, DivisorsHash j) { return i.getKey() < j.getKey(); }

class ProblemA {
public:

    /// ctor by default is empty
    ProblemA () {}

```

```

~ProblemA() {}

void setKeys (std::vector<int> _keys) { keys=_keys; return;}

std::vector<DivisorsHash> generate ( ) const {
    std::vector<DivisorsHash> divisors;
    for (int i=0; i<keys.size();i++) {
        divisors.push_back(DivisorsHash());
        divisors.back().setKey(keys[i]);
        divisors.back().findDivisors();
    }

    return divisors;
}

/// to print out the ProblemA
friend std::ostream & operator <<(std::ostream & out,
    const ProblemA & right){

    std::vector<DivisorsHash> Divisors = right.generate();
    std::sort(Divisors.begin(),Divisors.end(),wayToSort);
    out<<"{\n";
    for (int i=0; i< Divisors.size(); i++)
        {out<<"\t"; out<< Divisors[i]; out<<"\n";}
    out<<"}\n";
}

private:

    std::vector<int> keys;
    std::vector<DivisorsHash> divisors;

};

#endif

```

The steering program main() uses the class DivisorsHash and class ProblemA are in the following manner

```

#include "ProblemA.h"
#include <fstream>
#include <iostream>
#include <vector>

using namespace std;
int main ()
{

    int indexs [] = {7,4,2,10,3,6,18,5};
    size_t size = sizeof(indexs)/sizeof(int);
    std::vector<int> vec_indx (size);

```

```

    vec_idx.assign(indexs,indexs+size);

    ProblemA prblmA;

    prblmA.setKeys(vec_idx);

    cout<<prblmA;

return 0;
}

```

It produces the output:

```

{
    2 => [1],
    3 => [1],
    4 => [1,2],
    5 => [1],
    6 => [1,2,3],
    7 => [1],
    10 => [1,2,5],
    18 => [1,2,3,6,9],
}

```

```

def test():
    """ test """
    print "How are you"?

    return

```

1.2.2 Task A in Python

The same classes were written using the syntax of Python. Two modules

- DivisorsHash.py and
- ProblemA.py

were developed to code the task.

```
cat scripts/ProblemA/DivisorsHash.py
```

```

#!/usr/bin/env python

"""
This is the DivisorsHash class to generate and store divisors of any numeric key

    "DivisorsHash { key: 'number' => value: 'divisors of the number in the list' }"

To test the class :

    ./%prog --test --debug

```

```
"""

__author__ = 'Igor Marfin'
__copyright__ = "Copyright 2013, DESY HiggsGroup"
__credits__ = ["Igor Marfin", "DESY HiggsGroup"]
__license__ = "GPL"
__version__ = "0.0.1"
__maintainer__ = "Igor Marfin"
__email__ = "marfin@mail.desy.de"
__status__ = "Test"

# import all modules which might be useful

import time
import os
import sys
import commands
import re
from optparse import OptionParser

import types
import math
import unittest
import logging
import inspect

parser2=OptionParser(usage=__doc__)

parser2.add_option("--test",dest="test",
help="to perform test of helper classes",
default=False,action="store_true")
parser2.add_option("--debug",dest="debug",
help="to print debug info",default=False,action="store_true")
parser2.add_option("--tkinter",dest="tkinter",
help="to print debug info",default=False,action="store_true")

if ("pydoc" in str(sys.argv)):
    parser2.add_option("-w",dest="none",default=False,action="store_true")

(options2,args2)=parser2.parse_args()

#####
# Logging Service
#####
#
# logging level
if options2.debug:
```



```

LOG_LEVEL=logging.DEBUG
logging.basicConfig(stream=sys.stderr, level=LOG_LEVEL)
logger = logging.getLogger(inspect.stack()[-1][1])
else:
    LOG_LEVEL=logging.WARNING
    logging.basicConfig(stream=sys.stderr, level=LOG_LEVEL)
    logger = logging.getLogger(inspect.stack()[-1][1])

#
#my autolog
#
def autolog(message,mylogger=None):
    """ to print debug messages """

    # Get the previous frame in the stack, otherwise it would
    # be this function!!!
    func = inspect.currentframe().f_back.f_code
    # Dump the message + the name of this function to the log.
    if (mylogger==None):
        logger.debug("%s in %i ==> %s " % (
            func.co_name,
            func.co_firstlineno,
            message
        ))
    else:
        mylogger.debug("%s in %s:%i ==> %s " % (
            func.co_name,
            func.co_filename,
            func.co_firstlineno,
            message
        ))
    return
#####

"""
helper classes and tests

"""

class DivisorsHash(object):
    """ class to store and generate divisors """

    def __init__(self, key=None):
        """ constructor """
        self.logger = logging.getLogger(self.__class__.__name__)
        self.__key=key
        self.__divisors=[]
        pass

    def setKey(self,key=None):
        """ to set the key """

```

```

if key == None:
    self.logger.warning("provide me a numeric key")
    raise ValueError("key is empty ")
if not isinstance(key, types.IntType): raise TypeError("key is non-integer")
self.__key=key
pass

def getKey(self):
    """ to get the key """
    return self.__key

def findDivisors(self):
    """ find and returns all divisors (as an ordered list) """

    if (self.__key == None):
        self.logger.warning("provide me a numeric key")
        raise ValueError("key is empty ")

    if not isinstance(self.__key, types.IntType): raise TypeError("key is non-integer")

    if self.__key < 0 : self.__key*=-1
    keysqrt = math.sqrt(self.__key)
    for i in range(1,int(keysqrt)+1):
        if self.__key%i==0:
            self.__divisors.append(i)
            if i>1 and i<self.__key/i: self.__divisors.append(self.__key/i)
    self.__divisors.sort()
    return self.__divisors

def getDivisors(self):
    """ return the list of divisors """
    return self.__divisors

# uncomment the line if you need a public "key" attribute
# key = property(getKey, setKey)

def __repr__(self):
    """ return the representation "{ key: 'number' => value: 'divisors of the number in the list' }" """
    return " key: %d => %s " %(self.getKey(),repr(self.getDivisors()))

def __str__(self):
    """ return the representation "{ key: 'number' => value: 'divisors of the number in the list' }" """
    return " key: %d => %s " %(self.getKey(),repr(self.getDivisors()))

```

```

class MyTests(unittest.TestCase):
    """ to test features """

    def __ini__(self):
        pass

    def test1(self):
        """ to test setKey()/getKey() """

```

```
autolog("test of setKey() ")

dh = DivisorsHash()
try:
    dh.setKey(None)
except Exception as e:
    autolog("Some problems are detected: %s"%e)

try:
    dh.setKey("test")
except Exception as e:
    autolog("Some problems are detected: %s"%e)

try:
    dh.setKey(10)
    autolog("the key is %d"%dh.getKey())
except Exception as e:
    autolog("Some problems are detected: %s"%e)

self.failUnless(True)

def test2(self):
    """ to test findDivisors() """

    autolog("test of findDivisors() ")

    dh = DivisorsHash()

    try:
        dh.setKey(10)
        autolog("the key is %d"%dh.getKey())
        autolog("the list of divisors is %s"%repr(dh.findDivisors()))
    except Exception as e:
        autolog("Some problems are detected: %s"%e)

    self.failUnless(True)

def test3(self):
    """ to test representation of DivisorsHash """

    autolog("test of __str__() ")

    dh = DivisorsHash()

    try:
        dh.setKey(10)
        dh.findDivisors()
        autolog("%s"%dh)
    except Exception as e:
        autolog("Some problems are detected: %s"%e)
```

```

self.failUnless(True)

"""
main subroutine
"""

if __name__ == '__main__':
    """ main subroutine """

### read options and prepare settings

if options2.test and str(__status__).lower()=="test":
    autolog("Test of the helper classes:\n\n\n")
    sys.argv=[sys.argv[0]]
    unittest.main()

```

The following features are exploited in the code:

- logging service to dump the debug information;
- rising Exception to indicate the wrong input given by user;
- __str__() and __repr__() methods to properly print out the DivisorsHash;
- Implementation of class unittest.TestCase to make basic tests of the functionality.

The class problemA has logging service, __str__() and __repr__() supports. But unittest.TestCase is not introduced. The module ProbleA has two entry points used in the setup.py tool. This will be discussed later.

cat scripts/ProblemA/ProblemA.py

```

#!/usr/bin/env python

"""
This is the ProblemA class to generate divisors of numeric keys in a list:

Example Input:
[7,4,2,10,3,6,4,5]

Example Output:
{
2 => [1],
3 => [1],
4 => [1,2],
5 => [1],
6 => [1,2,3],
7 => [1],
10 => [1,2,5],
}

```

To test the class :

```
./%prog [--debug] [--tkinter] <args>
where <args> is the space-separated list of numbers: 7 4 2 10 3 6 4 5
```

```
"""
```

```
__author__ = 'Igor Marfin'
__copyright__ = "Copyright 2013, DESY HiggsGroup"
__credits__ = ["Igor Marfin", "DESY HiggsGroup"]
__license__ = "GPL"
__version__ = "0.0.1"
__maintainer__ = "Igor Marfin"
__email__ = "marfin@mail.desy.de"
__status__ = "Test"
```

```
# import all modules which might be useful
```

```
import time
import os
import sys
import commands
import re
from optparse import OptionParser
```

```
import types
import math
import unittest
import logging
import inspect
```

```
parser=OptionParser(usage=__doc__)
```

```
parser.add_option("--debug",dest="debug",
help="to print debug info",default=False,action="store_true")
parser.add_option("--tkinter",dest="tkinter",
help="to start gui",default=False,action="store_true")
```

```
if ("pydoc" in str(sys.argv)):
    parser.add_option("-w",dest="none",default=False,action="store_true")
```

```
(options,args)=parser.parse_args()
```

```
#####
```

```
# Logging Service
#####
```

```

#
# logging level
if options.debug:
    LOG_LEVEL=logging.DEBUG
    logging.basicConfig(stream=sys.stderr, level=LOG_LEVEL)
    logger = logging.getLogger(inspect.stack()[-1][1])
else:
    LOG_LEVEL=logging.WARNING
    logging.basicConfig(stream=sys.stderr, level=LOG_LEVEL)
    logger = logging.getLogger(inspect.stack()[-1][1])

#
#my autolog
#
def autolog(message,mylogger=None):
    """ to print debug messages """

    # Get the previous frame in the stack, otherwise it would
    # be this function!!!
    func = inspect.currentframe().f_back.f_code
    # Dump the message + the name of this function to the log.
    if (mylogger==None):
        logger.debug("%s in %i ==> %s " % (
            func.co_name,
            func.co_firstlineno,
            message
        ))
    else:
        mylogger.debug("%s in %s:%i ==> %s " % (
            func.co_name,
            func.co_filename,
            func.co_firstlineno,
            message
        ))
    return
#####

"""
helper classes and tests
"""

from DivisorsHash import DivisorsHash

class ProblemA(object):
    """ class of ProblemA """

```

```

def __init__(self, keys=None):
    """ constructor """
    self.logger = logging.getLogger(self.__class__.__name__)
    self.__keys=keys
    self.__divisors=[]
    if ( isinstance(keys,types.ListType)): self.__keys.sort()
    pass

def setKeys(self,keys=None):
    """ to set the keys """
    if keys == None:
        self.logger.warning("provide me a numeric key")
        raise ValueError("keys are empty ")
    if ( not isinstance(keys,types.ListType)):
        raise TypeError("It's not the list of keys")
    if not all(isinstance(key, types.IntType) for key in keys):
        raise TypeError("keys are not integers all")
    self.__keys=keys
    self.__keys.sort()
    pass

def generate(self):
    """ to generate divisors for all input number """
    if self.__keys == None:
        self.logger.warning("provide me a numeric key")
        raise ValueError("keys are empty ")
    if ( not isinstance(self.__keys,types.ListType)):
        raise TypeError("It's not the list of keys")
    if not all(isinstance(key, types.IntType) for key in self.__keys):
        raise TypeError("keys are not integers all")
    for key in self.__keys:
        dh=DivisorsHash(key)
        dh.findDivisors()
        self.__divisors.append(dh)
    return self.__divisors

def __repr__(self):
    """ return the list of the representation "{ key:
    'number' => value: 'divisors of the number in the list' }" """
    str1="{\n"
    for i in range(len(self.__keys)):
        if (i<len(self.__keys)-1): str1+=repr(self.__divisors[i])+",\n"
        else: str1+=repr(self.__divisors[i])+"\n } \n"

    return str1

def __str__(self):

```

```

""" return the list of the representation
  "{ key: 'number' => value: 'divisors of the number in the list' }" """
str1="{\n"
for i in range(len(self.__keys)):
    if (i<len(self.__keys)-1): str1+=str(self.__divisors[i])+",\n"
    else: str1+=str(self.__divisors[i])+"\n } \n"

return str1


"""
main subroutine

"""

def main():
    """ main subroutine """

    ### read options and prepare settings

    if (len(args)<1):
        print "provide the input list"
        print __doc__
    else:
        keys=[int(x) for x in args]
        pA = ProblemA()
        pA.setKeys(keys)
        pA.generate()
        print pA
    return

def mainTkinter():
    """ main subroutine with GUI """

    import Tkinter

    class simpleapp_tk(Tkinter.Tk):
        def __init__(self,parent):
            Tkinter.Tk.__init__(self,parent)
            self.parent = parent
            self.initialize()
        pass

        def initialize(self):
            self.grid()
            self.title("ProblemA")

            self.entryVariable = Tkinter.StringVar()
            self.labelVariable = Tkinter.StringVar()

```



```

self.entry = Tkinter.Entry(self, textvariable=self.entryVariable)
self.entry.bind("<Return>", self.OnPressEnter)
self.entry.grid(column=0, row=0, sticky='EW')

button = Tkinter.Button(self, text=u"Process Numbers !",
                        command=self.OnButtonClick)
button.grid(column=1, row=0)

label = Tkinter.Label(self, textvariable=self.labelVariable,
                      anchor="w", fg="white", bg="blue")
label.grid(column=0, row=1, columnspan=2, sticky='EW')

self.grid_columnconfigure(0, weight=1)
self.resizable(True, False)

pass

def OnButtonClick(self):
    self.OnPressEnter(self)

def OnPressEnter(self, event):
    args1 = self.entryVariable.get().split()
    keys=[int(x) for x in args1]
    pA = ProblemA()
    pA.setKeys(keys)
    pA.generate()
    self.labelVariable.set("%s"%pA)

app = simpleapp_tk(None)
app.mainloop()
return

if __name__ == '__main__':
    """ main subroutine """

    if options.tkinter: mainTkinter()
    else: main()

```

The option `--tkinter` and the entry point `mainTkinter()` are intended to implement the GUI using Tkinter windows manager [\[tkinter\]](#). Running the scripts/`ProblemA/ProblemA.py --tkinter` will give the window like one shown in the [Figure 1](#).

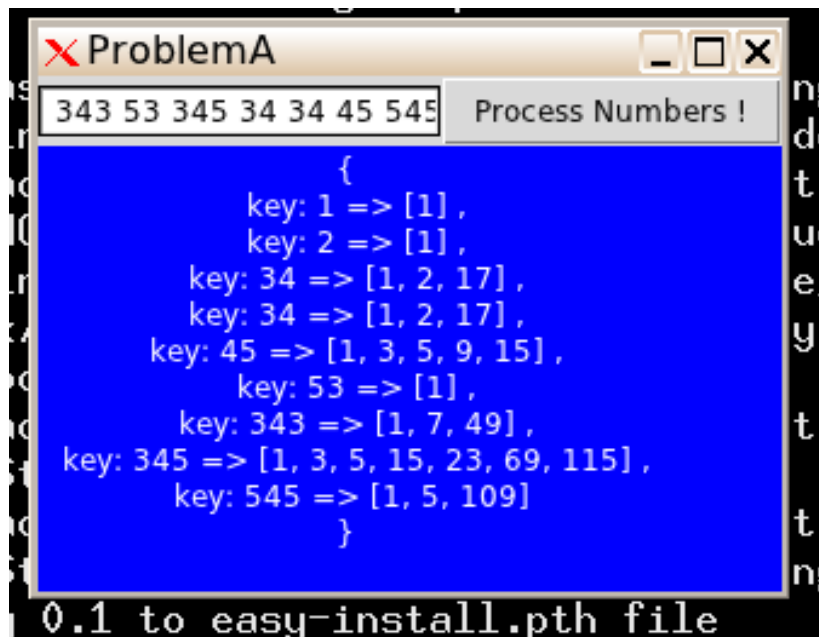


Figure 1. Tkinter window realized in ProblemA

1.2.3 Task A installation in Python

To install properly ProblemA.py and DivisorsHash.py modules, we organized them in the package ProblemA with `__init__.py` support [\[python_package\]](#). This is a tree of the package [\[tree\]](#)

```
scripts/ProblemA/
|---- DivisorsHash.py
|---- DivisorsHash.pyc
|---- __init__.py
|---- __init__.pyc
|---- ProblemA.py
|---- ProblemA.pyc

0 directories, 6 files
```

The `__init__.py` file declares the content of the ProblemA python package:

```
__all__ = ['DivisorsHash', 'ProblemA', 'main' ]

# deprecated to keep older scripts who import this from breaking
# from ProblemA.DivisorsHash import DivisorsHash
from DivisorsHash import DivisorsHash
from ProblemA import ProblemA
from ProblemA import main
```

The `setup.py` file was designed to make python packages to be installed in the easiest way [\[pip\]](#):

```
#!/usr/bin/env python

from setuptools import setup, find_packages
```

```

from setuptools.command.install import install
from setuptools.command.bdist_egg import bdist_egg as _bdist_egg

"""
taken from

http://www.niteoweb.com/blog/setuptools-run-custom-code-during-install
http://stackoverflow.com/questions/20194565/running-custom-setuptools-build-during-install
https://github.com/quasiyoke/keys\_of\_peace/blob/master/setup.py
"""

"""
class bdist_egg(_bdist_egg):
    def run(self):
        self.run_command('build_css')
        _bdist_egg.run(self)
"""

class CustomInstallCommand(install):
    """Customized setuptools install command - prints a friendly greeting."""
    sub_commands = install.sub_commands + [('test', None)]

    def run(self):
        print "Hello, developer, how are you? :)"
        install.run(self)

setup(
    name = "HitFox_Case_Study",
    version = "0.1",
    packages = find_packages(),
    # scripts = ['ProblemA.py'],

    entry_points = {
        'console_scripts': [
#             'ProblemA_python = ProblemA.ProblemA:main' # console app
            'ProblemA_python = ProblemA.ProblemA:mainTkinter', # window app
            'ProblemB_python = ProblemB.ProblemB:mainTkinter' # window app
        ],
    },

    # Project uses reStructuredText, so ensure that the docutils get
    # installed or upgraded on the target machine
    install_requires = ['docutils>=0.3', 'PIL>=1.1.7'],

    package_data = {
        # If any package contains *.txt or *.rst files, include them:
        '': ['*.rst'],
    },

    cmdclass={

```

```

        'install': CustomInstallCommand,
    },

# instead of

#     test_suite = 'ProblemB.suite',

# use

```

```
# python setup.py test --test-suite='ProblemB.suite'

tests_require = 'docutils >= 0.3',

# metadata for upload to PyPI
author = "Igor Marfin",
author_email = "me@example.com",
description = "This is an Example Package",
license = "GPL",
keywords = "HitFox Case Study",
url = "https://github.com/igormarfin/HitFox_Case_Study.git", # project home page, if any

# could also include long_description, download_url, classifiers, etc.
)
```

This setup.py file allows to setup the python projects in three different ways:

```
# First, CREATE .egg file

python setup.py bdist_egg

# Then install
# EASY_INSTALL METHOD (requires the .egg file) (Method 1)

myplace=/mnt/WorkingPlace/Case_Study/hitfox/python/test
script_dir=/mnt/WorkingPlace/Case_Study/hitfox/bin
python_prefix=lib/python2.7/site-packages
mkdir -p ${myplace}/${python_prefix}
sudo sh -c "export PYTHONPATH=${myplace}/${python_prefix}:$PYTHONPATH;\
easy_install --prefix=${myplace} dist/HitFox_Case_Study-0.1-py2.7.egg "

# install running script into different folder with EASY_INSTALL METHOD
sudo sh -c "export PYTHONPATH=${myplace}/${python_prefix}:$PYTHONPATH;\
easy_install --install-dir=${myplace}/${python_prefix} --script-dir=${script_dir}\
dist/HitFox_Case_Study-0.1-py2.7.egg "

# SETUP.PY METHOD (requires the folder with srcs, here
# the project folder is 'ProblemA' ) (Method 2)

mkdir -p ${myplace}/${python_prefix}
export PYTHONPATH=${myplace}/${python_prefix}:$PYTHONPATH
python setup.py install --prefix=${myplace}

# PIP METHOD (Method 3)

#first, create a tgz or folder project:
python setup.py sdist

sudo sh -c "export PYTHONPATH=${myplace}/${python_prefix}:$PYTHONPATH;\
pip install -e /mnt/WorkingPlace/Case_Study/hitfox/python/HitFox\ Case\ Study-0.1/\
--install-option=\"--prefix=${myplace}\" " "
```

The python projects supports also unittests, which are used here to test python features and the system to have some external tools needed for properly workflow and compiling of the code. One can simply run

```
python setup.py test --test-suite='ProblemB.suite'
```

to test. This command is implemented in Makefile.

2 Makefile - the way to build and install the projects

To build projects in C/C++, python and upload them to SVN and GIT repos, the Makefile is created. The following keywords, i.e make keyword, are supported:

all	Commit2SVN	info	makeSVN
clean	DEPENDENCE.ProblemB_python	Makefile	rm_python_dirs
Commit2Git	dirs2SVN	makeGit	

The Makefile is based on the use of hast tables (associative arrays) [makefile_assoc] and technique for processing multiple sub-folders with one Makefile [makefile_trick]. Each sub-project, either C/C++ or python, or JAVA, has two its own FLAGS (for compiling) and dependencies, like

```
#### Specific settings
DEPENDENCE.DivisorsHash           :=
DEPENDENCE.ProblemA                := $(INC_DIR)/DivisorsHash.h
DEPENDENCE.Node                    := $(INC_DIR)/Node_Edge.cc
DEPENDENCE.Graph                   := $(INC_DIR)/Node_Edge.cc
DEPENDENCE.ProblemB                := $(INC_DIR)/Node_Edge.cc

FLAGS.ProblemB                     := -DINT_MAX=100000

DEPENDENCE.ProblemB_python          := DEPENDENCE.ProblemB_python

DEPENDENCE.ProblemB_python:
    cd $(PYTHON_DIR) ; python setup.py test --test-suite='ProblemB.suite';
```

which are used to independently assemble the different sub-projects.

To build and setup executables, just do

```
make clean
make
```

Also, SVN and GIT repositories are supported. If user has registered to googlecode.com or github.com, it is possible to run the commands

```
# to creat SVN repo and upload the projects
make clean
make makeSVN
make dirs2SVN
sudo make Commit2SVN

# to create GIT repo and upload the projects
make clean
make makeGit
make Commit2Git
```

The `` cat Makefile`` gives:

```
#### Common settings

PROJECT          := HitFox_Case_Study
TMPDIR = $$HOME/tmp/$(PROJECT)
TMPDIR2SVN = $$HOME/tmp/$(PROJECT)/SVN
CURDIR=$(shell pwd)
Dirs             := ${shell find . -type d | grep -v ".svn" | grep "./"}

### SVN repo settings
SVNREPO          := https://my-code-iggy-floyd-de.googlecode.com/svn/branches
SVNUSER          := iggy.floyd.de@gmail.com

### GIT repo settings
GITREPOPATH      := https://api.github.com/user/repos
GITREPO          := $(PROJECT)
GITUSER          := igormarfin

### Compilers settings and C/C++ src/includes

CXX              := g++
CPPFLAGS         := -g
SRC_DIR          := src
BIN_DIR          := bin
INC_DIR          := include

INCLUDES         := $(addprefix -I, $(INC_DIR))
SRC              := $(foreach sdir,$(SRC_DIR),$(wildcard $(sdir)/*.cc))
PROGS            := $(patsubst $(SRC_DIR)/%.cc,%, $(SRC))
HEADERS          := $(patsubst $(SRC_DIR)/%.cc,$(INC_DIR)/%.h,$(SRC))
PROGS_IN_BIN     := $(patsubst src/%.cc,$(BIN_DIR)/%, $(SRC))

### python programs settings

PYTHON_DIR       := scripts
PYTHON_INSTALL   := $(shell echo `pwd`/$(PYTHON_DIR)/test)

PYTHON_SRC       := $(shell ls -d $(PYTHON_DIR)/* | grep -v "build" | grep -v "dist" \
| grep -v $(PROJECT) | grep -v "test")
PYTHON_SRC       := $(patsubst $(PYTHON_DIR)/%,%, $(PYTHON_SRC))
PYTHON_SRC       := $(patsubst %/,%, $(PYTHON_SRC))

PYTHON_PROGS_IN_BIN := $(addprefix $(BIN_DIR)/,$(patsubst %, %_python, $(PYTHON_SRC)))
PYTHON_PREFIX    := lib/python2.7/site-packages

VPATH            := $(SRC_DIR) $(PYTHON_DIR) $(addprefix $(PYTHON_DIR)/, $(PYTHON_SRC))
FLAGS            := -std=c++0x

#### Specific settings for C/C++ executables
DEPENDENCE.DivisorsHash :=
DEPENDENCE.ProblemA      := $(INC_DIR)/DivisorsHash.h
```

```

DEPENDENCE.Node                := $(INC_DIR)/Node_Edge.cc
DEPENDENCE.Graph               := $(INC_DIR)/Node_Edge.cc
DEPENDENCE.ProblemB            := $(INC_DIR)/Node_Edge.cc

FLAGS.ProblemB                 := -DINT_MAX=100000

all: rm_python_dirs    $(PROGS_IN_BIN) $(PYTHON_PROGS_IN_BIN)

#### Specific setting for python executables
DEPENDENCE.ProblemB_python     := DEPENDENCE.ProblemB_python

DEPENDENCE.ProblemB_python:
    cd $(PYTHON_DIR) ; python setup.py test --test-suite='ProblemB.suite';

#### To clear python directories

rm_python_dirs:
- rm -r $(shell echo `pwd`/$(PYTHON_DIR))/dist
- rm -r $(shell echo `pwd`/$(PYTHON_DIR))/build
- rm -r $(shell echo `pwd`/$(PYTHON_DIR)/$(PROJECT).egg-info
- rm -r $(shell echo `pwd`/$(PYTHON_DIR))/test

define make-goal
$(BIN_DIR)/$1: $2 $3 ${DEPENDENCE.$1}
    $(CXX) $(INCLUDES) $(CPPFLAGS) $(FLAGS) ${FLAGS.$1} $$< ${DEPENDENCE.$1} -o $$@
endef

define make-goal-python
$(BIN_DIR)/$1: $2 ${DEPENDENCE.$1}
    cd $(PYTHON_DIR); python setup.py bdist_egg;
    mkdir -p $(PYTHON_INSTALL)/$(PYTHON_PREFIX)
    sudo sh -c "export PYTHONPATH=$(PYTHON_INSTALL)/$(PYTHON_PREFIX):${PYTHONPATH};\
    easy_install --install-dir=$(PYTHON_INSTALL)/$(PYTHON_PREFIX)\
    --script-dir=$(shell echo `pwd`/$(BIN_DIR)) $(shell echo `pwd`/$(PYTHON_DIR)/dist/$(PROJECT)\
    -0.1-py2.7.egg)"
    echo export PYTHONPATH=$(PYTHON_INSTALL)/$(PYTHON_PREFIX):${PYTHONPATH}
endef

info:
    $(info SOURCES:      $(SRC))
    $(info PROGRAMS:     $(PROGS))
    $(info INCLUDES:     $(INCLUDES))
    $(info HEADERS:      $(HEADERS))

```

```

$(info PYTHON_SRC:      $(PYTHON_SRC))
$(info PYTHON_INSTALL:  $(PYTHON_INSTALL))
$(info PYTHON_PROGS_IN_BIN:  $(PYTHON_PROGS_IN_BIN))

```

```

clean: rm_python_dirs
- rm $(BIN_DIR)/*

```

```

$(foreach prog,$(PYTHON_SRC),$(eval $(call make-goal-python,$(prog)_python,\
    $(PYTHON_DIR)/$(prog)/$(prog).py )))

```

```

$(foreach prog,$(PROGS),$(eval $(call make-goal,$(prog),$(SRC_DIR)/$(prog).cc,\
    $(INC_DIR)/$(prog).h )))

###SVN support
makeSVN:
    svn mkdir $(SVNREPO)/$(PROJECT) --username $(SVNUSER) ;\

dirs2SVN:
-   for dir in $(Dirs); do \
    svn mkdir $(SVNREPO)/$(PROJECT)/${dir} --username $(SVNUSER) "adding ${dir}" ; \
done;

Commit2SVN:
    mkdir -p $(TMPDIR2SVN); \
    cd $(TMPDIR2SVN) ; \
    svn co $(SVNREPO)/$(PROJECT); \
    ls ; \
    cd - ; \
    find ./ -iname "*" | grep -v "*.svn*" | xargs -I {} install -D {} \
    $(TMPDIR2SVN)/$(PROJECT)/{} ; \
    cd $(TMPDIR2SVN)/$(PROJECT) \
    ls ;\
    pwd ;\
    svn status | grep '?' | sed 's/^.* /svn add --parents --force\
    --username $(SVNUSER) /' | bash ; \
    svn ci ; \
    cd $(CURDIR) ;\
    rm -r $(TMPDIR2SVN);

#####Git support
makeGit:
    curl -u '$(GITUSER)' $(GITREPOPATH) -d '{"name":"$(GITREPO)}'

Commit2Git:
    git init
    git add ./
    git commit -m "adding to GitHub.com"
    git remote add origin git@github.com:$(GITUSER)/$(GITREPO).git
    git push -u origin master

.PHONY: all info clean rm_python_dirs makeSVN dirs2SVN Commit2SVN

```

3 Task B

3.1 Introduction to Taks B

- Find shortest path
- Given is a directed & weighted graph defined by the following interfaces:

```

public Interface IGraph {
    public Set<INode> getNodes();
}

public interface INode {
    public String getName();
    public List<IEdge> getEdges();
}

```



```
public interface IEdge {
    public INode getOriginNode();
    public INode getTargetNode();
    public int getWeight();
}
```

- Code an algorithm which finds the shortest path between two given nodes. Tasks:

- Fill class Path.
- Fill method `IPath getShortestPath(...)` on class ProblemB.

```
public interface IPath {
    public List<Node> getPath();
    public int getTotalWeight();
}

public class Path implements IPath(){
    // TODO
}

public class ProblemB {
    private IGraph graph;
    public ProblemB(IGraph graph){
        this.graph = graph;
    }

    public IPath getShortestPath(INode initNode, INode endNode){
        // TODO
    }
}
```

3.2 Realization of Taks B

First of all, some efforts were needed to find the algorithms for the theory of graphs. I've considered, studied and tested the following methods:

- Breadth-first search (BFS) is good to search in unweighted graphs using a "queue" datastructures [\[BFS\]](#);
- Depth-first search is as BFS but uses stacks [\[DFS\]](#);
- Dijkstra algorithm solves the single-source shortest path problem for a graph with non-negative edge path costs [\[Dijk\]](#).

Finally, I've created a method which is a mixture of BFS, using ideas discussed in the post [\[BFS_post\]](#), and the pseudo code from Dijkstra's algorithm published in the wiki [\[Dijk\]](#). Insead of using a priority queues [\[priority_q\]](#), I've exploited sorted sets of nodes. Sorting was done by means of comparing `pair<float,int>` [\[pair_type\]](#) structures.

4 Section Second

4.1 Bullet Lists

- A bullet list

- Nested bullet list.
- Nested item 2.
- Item 2.
- Paragraph 2 of item 2.
- Nested bullet list.
- Nested item 2.
- Third level.
- Item 2.
- Nested item 3.

4.2 Enumerated Lists

1. Arabic numerals.
 - a. lower alpha)
 - i. (lower roman)
 - A. upper alpha.
2. Lists that don't start at "1":
 - I. upper roman)
 3. Three
 4. Four
 - C. C
 - D. D
 - iii. iii
 - iv. iv
3. List items may also be auto-enumerated.

4.3 Definition Lists

Term

Definition

Term : *classifier*

Definition paragraph 1.

Definition paragraph 2.

Term

Definition

5 Section Third

5.1 Literal Blocks

Literal blocks are indicated with a double-colon ("::") at the end of the preceding paragraph (over there -->). They can be indented:

```
if literal_block:
    text = 'is left as-is'
    spaces_and_linebreaks = 'are preserved'
    markup_processing = None
```

Or they can be quoted without indentation:

```
>> Great idea!
>
> Why didn't I think of that?
```

5.2 Block Quotes

Block quotes consist of indented body elements:

My theory by A. Elk. Brackets Miss, brackets. This theory goes as follows and begins now. All brontosaurus are thin at one end, much much thicker in the middle and then thin again at the far end. That is my theory, it is mine, and belongs to me and I own it, and what it is too.

Anne Elk (Miss)

5.3 Tables

Here's a grid table followed by a simple table:

Header row, column 1 (header rows optional)	Header 2	Header 3	Header 4
body row 1, column 1	column 2	column 3	column 4
body row 2	Cells may span columns.		
body row 3	Cells may span rows.	• Table cells	
body row 4		• contain • body elements.	
body row 5	Cells may also be empty: -->		

Inputs		Output
A	B	A or B
False	False	False
True	False	True
False	True	True
True	True	True

6 Section Fourth

6.1 Citations

Here's a reference to the above, [\[CIT2002\]](#) citation.

7 Section Fifth

7.1 Targets

This paragraph is pointed to by the explicit "example" target. A reference can be found under [Section Second](#), above.

Section headers are implicit targets, referred to by name. See [Targets](#).

Explicit external targets are interpolated into references such as "[Python](#)" or such as [\[2\]](#).

Targets may be indirect and anonymous. Thus [this phrase](#) may also refer to the [Targets](#) section.

8 Section Sixth

8.1 More details

you can find more details here [\[3\]](#) and here [\[4\]](#)

9 HOW-TO obtain different format from RST source

- the HTML format:

```
rst2html.py HOW-TO.rst --syntax-highlight="long" > HOW-TO.html
```

- the PDF format:

```
rst2pdf HOW-TO.rst
```

- the TeX format:

```
rst2latex HOW-TO.rst > HOW-TO.tex
```

- the twiki (for CERN twiki) format:

```
cat HOW-TO.rst | rst2twiki.py > HOW-TO.twiki
```

- the wiki format:

```
cat HOW-TO.rst | rst3wiki.py > HOW-TO.wiki
```

Good Luck!

10 References

CIT2002	Citations are text-labeled footnotes. They may be rendered separately and differently from footnotes.
2	http://www.python.org/
3	http://docutils.sourceforge.net/docs/user/rst/demo.txt http://docutils.sourceforge.net/docs/ref/rst/restructuredtext.txt http://docutils.sourceforge.net/rst.txt
4	http://docutils.sourceforge.net/docs/user/rst/demo.html#inline-markup
code	The code insertion are obtained using the following shell command <code>cat src/ProblemA.cc awk '{printf " %s\n", \$0}' > code.rst</code>
divisors_in_c	The fastest method to find all divisors http://www.cplusplus.com/forum/beginner/11510/
tkinter	Building a basic GUI application step-by-step in Python with Tkinter and wxPython http://sebsauvage.net/python/gui/#import
python_package	How do I write good/correct <code>__init__.py</code> files http://stackoverflow.com/questions/1944569/how-do-i-write-good-correct-init-py-files
tree	The package tree was built by means of <code>tree scripts/ProblemA</code>
	<p>The following materials were used during the preparation of the manual</p> http://mindref.blogspot.de/2010/06/python-setuptools.html http://stackoverflow.com/questions/20194565/running-custom-setuptools-build-during-install http://pythonhosted.org/an_example_pypi_project/setuptools.html http://programmingnotes.freeweq.com/?p=3737 http://guide.python-distribute.org/pip.html http://reinout.vanrees.org/weblog/2010/01/06/zest-releaser-entry-points.html http://pythonhosted.org/setuptools/ http://pythonhosted.org/setuptools/easy_install.html#compressed-installation http://www.siafoo.net/article/77 http://www.mxm.dk/2008/02/python-eggs-simple-introduction.html http://stackoverflow.com/questions/9185307/setup-py-and-installing-a-python-project http://mrtopf.de/blog/en/a-small-introduction-to-python-eggs/ http://stackoverflow.com/questions/9950362/how-do-i-create-python-eggs-from-distutils-source-packages
pip	http://stackoverflow.com/questions/739993/get-a-list-of-installed-python-modules
makefile_assoc	Makefile: find in array. http://stackoverflow.com/questions/7282414/makefile-find-in-array

	How to generate a Makefile with source in sub-directories using just one makefile http://stackoverflow.com/questions/231229/how-to-generate-a-makefile-with-source-
makefile_trick	in-sub-directories-using-just-one-makefil
	Breadth-first search
BFS	http://en.wikipedia.org/wiki/Breadth-first_search
	Depth-first search
DFS	http://en.wikipedia.org/wiki/Depth-first_search
	Dijkstra's algorithm
Dijk(1, 2)	http://en.wikipedia.org/wiki/Dijkstra%27s_algorithm
BFS_post	Using BFS to find shortest path (C++) http://blogse.quora.com/Using-BFS-to-find-shortest-path-C++
	Easiest way of using min priority queue with key update in C++ http://stackoverflow.com/questions/9209323/easiest-way-
priority_q	http://www.cplusplus.com/reference/algorithm/make_heap/ http://www.cplusplus.com/reference/algorithm/push_heap/ http://www.cplusplus.com/reference/algorithm/pop_heap/
	<code>std::pair</code>
pair_type	http://www.cplusplus.com/reference/utility/make_pair/ http://www.cplusplus.com/reference/utility/pair/
	A footnote contains body elements, consistently indented by at least 3 spaces.
1	This is the footnote's second paragraph.
5	Footnotes may be numbered, either manually (as in [1]) or automatically using a "#" -prefixed label. This footnote has a label so it can be referred to from multiple places, both as a footnote reference ([5]) and as a hyperlink reference (label).
6	This footnote is numbered automatically and anonymously using a label of "#" only.
*	Footnotes may also use symbols, specified with a "*" label. Here's a reference to the next footnote: [*] .
†	This footnote shows the next symbol in the sequence.