Question 1. Unit Testing in Python

Problem 1.

The code given in the textbook had an error which was spotted using pytest. I have created file, “test_problem_one” which contains a unit test with various test cases. The edge cases were checking for the integer number 1, any prime number and composite numbers which are of two types: odd and even.

The original code had “Assertion Error: failed for even composite numbers”. The range function doesn’t include the end value of a tuple, hence, +1 was implemented there. The modified code passed all the test cases mentioned in “test_problem_one”.
“for i in range(2, int(n**.5)):” was corrected to “for i in range(2, int(n**.5) + 1):”

Problem 2.
The coverage of py.test for problem 1 is 100% which implies that all the components of the file were run. The unit test for problem 2 is written under “test_problem_two.py”. It has four test cases based on whether the calendar month has 30 days, 31 days or is the month of February. For the February month, there are two separate cases checking for 29 or 28 days, given it’s a leap year or not. The pytest corresponding to problem 2 is exhaustive as it has 100% coverage.

Problem 3.
The unit test for problem 3 is written under “test_problem_three.py”. It incorporates the following three different errors which are raised in the code for problem 3: TypeError, ZeroDivisionError and ValueError. In addition to these errors, there are separate functions to check if the binary operators: ‘+’, ‘/’, ‘-‘ and ‘*’(add, divide, subtract and multiply, respectively) are functioning correctly.
It’s also exhaustive and has 100% coverage.

Question 2. Test driven development.

Part a.
NA

Part b.
The code is written in the file "get_r.py"

Part c.
"get_r.py" passes all the tests under file "test_r.py". The following output was obtained after running the tests:

```
C:\Users\Nipun\persp-analysis_A18\Assignments\A7\question_two>py.test --cov
============================= test session starts =============================
platform win32 -- Python 3.6.3, pytest-4.0.1, py-1.7.0, pluggy-0.8.0
rootdir: C:\Users\Nipun\persp-analysis_A18\Assignments\A7\question_two, inifile:

plugins: cov-2.6.0
collected 244 items

test_r.py .............................................................. [ 25%]
........................................................................ [ 54%]
........................................................................ [ 84%]
.......................................                                  [100%]

----------- coverage: platform win32, python 3.6.3-final-0 -----------
Name          Stmts   Miss  Cover
---------------------------------
get_r.py         15      0   100%
test_r.py        29      0   100%
---------------------------------
TOTAL            44      0   100%


========================= 244 passed in 1.69 seconds ==========================

C:\Users\Nipun\persp-analysis_A18\Assignments\A7\question_two>cd question_two
```

Question3. Watts (2014).

Part a.

In the 1960s, rational choice theory imposed a framework of theoretical assumptions that were either fitting or “rationalized” the observed behavior. The early model of rational choice theory was criticised “on the grounds that they relied on implausible or empirically invalid assumptions about the preferences, knowledge, and computational capabilities of the actors in question or, alternatively, that they yielded predictions that were also demonstrably at odds with empirical evidence.”[1] The assumptions requiring that the actions were forward-looking and purposive was also put to question by many scholars.

Part b.

According to Watts, the pitfall in using common sense theories of action is because “a theory can easily be perceived as true when it is false, or as more valid than it deserves to be, if it includes beside its explicit statements implicit unnoticed commonsensical statements, which, although valid in everyday life, are not of universal validity”[2]. According to Watts, the social scientists are invariably using the same mental simulation toolkit to understand behaviour and also to make predictions. The main pitfall in using common sense theories of action is substituting causality with understand-ability, which is weakening the scientific validity of the predictions and the explanations. In a sense, Watts is arguing that a process due to which certain behavior or action is observed is not the cause of that particular behavior or action.

Part c.

Watts’ proposed solution to the issues with rational choice modelling and causal explanation is “that prediction must be defined suitably—that is, in the broad sense of out-of-sample testing, allowing both for probabilistic predictions and for predictions about stylized facts or patterns of outcomes. Defined in this manner, moreover, prediction can be used to evaluate not only statistical models of “large-N” data but also mathematical or agent- based models (Hedström 2005), small-N comparative studies (Mahoney 2000), rational choice explanations of historical events (Kiser and Hector 1998), or even mental models based on intuition and experience. Although the details would differ depending on the type of explanation in question, in all cases the procedure would be roughly: (1) construct a “model” based on analysis of cases (A, B, C, . . .); (2) deploy the model to make a prediction about case X, which is in the same class as (A, B, C, . . .) but was not used to inform the model itself; (3) check the prediction.”[3]

Part d.

Theoretical models- with their necessary simplifications and their specific assumptions about mechanisms- enriches causal inference and predictions. The models with all the assumptions thoroughly describe the process which leads to observation of certain actions and behavior. Therefore, the researcher can obtain more insightful causal inference and predictions. It also provides researcher with a room to make a more robust model by playing around with the necessary and sufficient assumptions. However, the researcher should not fall for confusing the given process with causality. The mechanism due to which a certain behavior is observed is not the explanation for that observed behavior.

[1, 2, 3] Watts, Duncan J. "Common sense and sociological explanations." *American Journal of Sociology* 120, no. 2 (2014): 313-351.