

## Joy and Beauty of Data, Third Practicum – April 28, 2017

Name \_\_\_\_\_

Question One. 25 points. Notice that the contents of each cell in the matrix below is the sum of its row (zero-based) and column (zero-based). Using two nested for loops, supply the missing code below to produce the following output:

```
[[0 1 2 3]
 [1 2 3 4]
 [2 3 4 5]
 [3 4 5 6]]
```

---

```
import numpy as np
numbers = np.empty([4,4], dtype='int64')

# the 3 missing lines of code go here

print(numbers)
```

Question Two. 25 points.

Part A. 5 points. Show how to create a variable named **some-variable** that produces the following output when **type(some-variable)** is entered into the Python shell: *<class 'numpy.ndarray'>*

Part B. 5 points. Show how to create a variable named **some-variable** that produces the following output when **some-variable.dtype** is entered into the Python shell: *dtype('int64')*

Part C. 5 points. Show the contents of the variable **numbers** if the user enters a 3.

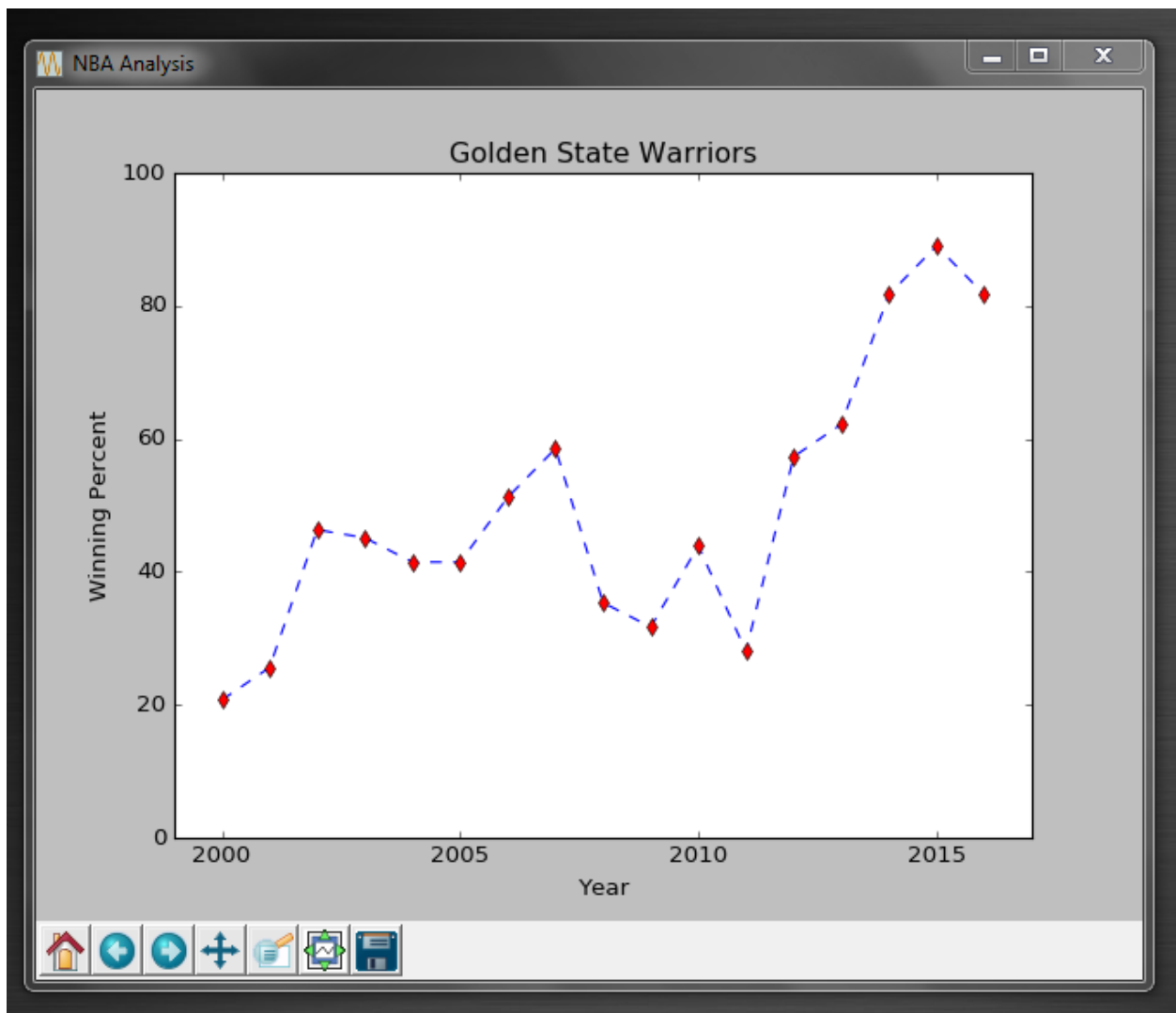
```
import numpy
number = int(input("Enter an integer: "))
numbers = numpy.arange(number * number).reshape(number, number)
```

Part D. 10 points. Use string slicing to access the middle column of the following tic-tac-toe board using just one statement.

```
import numpy
tictactoe = numpy.array([[ "x", "x", "o"], ["o", "o", "x"], ["x", "x", "o"]])
```

Question Three. 50 points. Visualization.

Complete the program below such that it matches the following graph as closely as possible:



```
import pandas as pd
import matplotlib.pyplot as plt
```