OLLSCOIL NA hÉIREANN
THE NATIONAL UNIVERSITY OF IRELAND, CORK

COLÁISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

2017/2018
Semester 1 – Winter 2017

BSc Computer Science

CS3318: Advanced Programming With Java

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Answer *ALL* questions

Total Marks
80

Time Allowed
$1\frac{1}{2}$ Hours

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INSTRUCTED TO DO SO
ENSURE THAT YOU HAVE THE CORRECT EXAM PAPER

1. **Topic: Java Programming** (30 MARKS)

a) Java has a number of coding conventions, covering topics such as indentation, naming and file organisation. Explain why these coding conventions are important. *(5 marks)*

b) Explain how the addition of default methods to interfaces removes many of the reasons for using abstract classes. *(5 marks)*

c) Create a `Calculator` API

i. That defines `add`, `subtract`, `divide`, and `multiply` operations. *(2 marks)*

ii. That provides a `BasicCalculator` implementation to illustrate to other programmers how the interface is used. *(4 marks)*

iii. If you see code such as

```
BasicCalculator calculator = new BasicCalculator();
int sum = calculator.add(1, 2);
```

what problem has this highlighted? How could you prevent this? *(4 marks)*

d) The use of documentation is essential for supporting a programmer using an API.

i. Explain how correctly written Javadoc can help a programmer understand an API. *(4 marks)*

ii. Use Javadoc to document the `Calculator` API. *(6 marks)*

2. **Development Tools and Techniques** (30 MARKS)

a) Three Java build automation tools are `ant`, `maven` and `gradle`. Which of these tools would you recommend for a standard Java project? Justify your answer. *(5 marks)*

b) Compare and contrast the workflows when using a centralised version control system and a distributed version control system. *(5 marks)*

c) Design by Contract requires designers to define precise and verifiable interface specifications for software components.

i. Explain how design by contract is complementary to defensive programming. *(3 marks)*

ii. Show how the Java assert statement can support an informal design by contract style of programming, by implementing the `search` method with the use of assertions.

```
/**
  * @param x the value to find in the array
  * @param a an array of values
  * @returns the position of x in the array
  * @throws IndexOutOfBoundsException
*/
int search(double x, double [] a) {
}
```

In your answer be sure to note what aspect of the contract each assert statement is enforcing. *(4 marks)*

d) Unit Testing is a level of software testing where individual units of software are tested.

i. Describe the expected benefits of writing unit tests. *(5 marks)*

ii. Write JUnit tests for the BasicCalculator class in Q1(c)ii. *(8 marks)*

3. **Application Development** (20 MARKS)

a) Exception handling is an important aspect of writing robust Java programs.

i. Briefly describe *three* recommended practices for exception handling in Java. (*6 marks*)

ii. Explain why the designer of an API may choose to use *exception translation.* (*4 marks*)

b) In JavaFX applications, events are notifications that something has happened.

i. Describe the JavaFX event delivery process. (*6 marks*)

ii. Show how a lambda expression can refactor the event handler code for `button` shown below. (*4 marks*)

```
final StringProperty btnText = button.textProperty();
button.setOnAction(new EventHandler<ActionEvent>() {
  @Override
  public void handle(ActionEvent actionEvent) {
    ToggleButton source = (ToggleButton) actionEvent.getSource();
    if (source.isSelected()) {
      btnText.set("Clicked!");
    } else {
      btnText.set("Click!");
    }
  }
});
```