Section 1.1: Software Engineering

True / False

1. True or False? The best approach to programming is to not waste any time worrying about what is needed and to just jump right in and start coding.

Answer: False

2. True or False? Software requirements describe what a program does but not how it does it.

Answer: True

3. True or False? The waterfall approach is useful when requirements are well understood and unlikely to change.

Answer: True

4. True or False? In today's environment, software requirements, once specified, seldom change.

Answer: False

Multiple Choice

5. Agile methods include _________________ .

A. detailed written specifications
B. incremental delivery of the product
C. carefully controlled development
D. significant testing after the entire system is created
E. all of these

Answer: B

6. The Spiral Life-Cycle Model emphasizes

A. risk management
B. pair programming
C. program efficiency
D. graphical visualization
E. all of the above

Answer: A

Fill-in-the-Blank

7. The software life-cycle model where one carefully follows a predetermined succession of stages, one after the other, is called the ______________ model.

Answer: waterfall

8. Software ___________________ are a detailed description of the functions, inputs, processing, outputs, and other requirements of a software product.

Answer: Specifications

9. The agile development approach where two programmers sit side by side, designing and coding, at a single work station is called _______________ .

Answer: pair programming

Short Answer

10. What are the four quality goals that all software should meet to some degree, as emphasized in the textbook?

Answer: Quality software works, can be modified without excessive time and effort, is reusable, and is completed on time and within budget.

11. What makes a program easy to modify?

Answer: It should be readable and understandable to humans. It should be well designed. It should be able to withstand small changes easily – therefore the different parts of the program should be relatively independent.

Section 1.2: Object Orientation

True / False

12. True or False? The first object-oriented language was created in the 1990's.

Answer: False

13. True or False? Object-oriented classes, when designed properly, are easy to reuse.

Answer: True

14. True or False? The Unified Method was the brainchild of a single software engineer, Grady Booch.

Answer: False

Multiple Choice

15. Objects can **represent** both

A. space and time efficiency
B. variables and constants
C. information and behavior
D. classes and inheritance
E. methods and constructors

Answer: C

16. A collection of specific procedures for creating a software system to meet a user's needs is called a ____________________ ?

A. specification
B. requirement
C. condition
D. responsibility
E. methodology

Answer: E

Fill-in-the-Blank

17. The first programming language to support object-oriented programming was ___________________ .

Answer: Simula 67

18. The ________________ Award was presented to Nygaard and Dahl in 2001 for their seminal work on object-orientation.

Answer: Turing

19. UML is an acronym for ____ .

Answer: Unified Modeling Language

Short Answer

20. What are the three key elements featured by the Unified Method, as described in the textbook?

Answer: It is use-case driven. It is architecture-centric. It is iterative and incremental.

Section 1.3: Classes, Objects, and Applications

True / False

21. True or False? An object defines the structure of a class.

Answer: False

22. A *private* variable cannot be accessed from anywhere.

Answer: False

23. A class definition can be used to create multiple objects.

Answer: True

24. Object methods are invoked through the class that defines the object.

Answer: False

25. Classes use applications to solve problems.

Answer: False

26. A class that contains a *main* method is called a Java application.

Answer: True

27. Constructors are classified as observer methods.

Answer: False

Multiple Choice

28. Within an object, actions are modeled using

A. variables
B. classes
C. methods
D. constants
E. none of these

Answer: C

29. Which kind a variable has a single copy maintained for all objects in a class?

A. instance variable
B. final variable
C. private variable
D. class variable
E. protected variable

Answer: D

30. Which kind of variable holds a value that cannot be changed?

A. instance variable
B. final variable
C. private variable
D. class variable
E. protected variable

Answer: B

Fill-in-the-Blank

31. A(n) ________________ is an instantiation of a class.

Answer: object

32. The process of creating a new object is called

Answer: instantiation

33. The return type of the following method is __________________ .

```
public String someMethod(int value1, int value2)
{
  int value;
  value = value1 + value2;
  return (“answer is “ + value);
}
```

Answer: String

34. The special method in a class that has the same name as the class itself is called a(n) _____________________ .

Answer: constructor

35. A method that simply returns information based on the instance variables of a class is called a(n) ____________________ method.

Answer: observer

36. A method that changes the internal state of an object is called a(n) ____________________ method.

Answer: transformer

37. We indicate *final* variables in a UML class diagram by _________________ them.

Answer: underlining

Short Answer

38. For what purpose are constructor methods used?

Answer: To create new instances of the class – that is, to instantiate objects of the class.

39. List the four types of access modifiers provided by Java and describe what they each control access to.

Answer: The public access modifier allows access from anywhere. The Protected access modifier allows access from within the class, or within subclasses in the same package, or within subclasses in other packages. Package access allows access from within the class or within subclasses in the same package. Finally, private access only allows access from within the class.

Section 1.4: Organizing Classes

True / False

40. True or False? If *class1* inherits from *class2* we say that *class1* is the superclass and *class2* is the subclass.

Answer: False

41. A subclass can redefined features inherited from its superclass.

Answer: True

42. If the Java compiler cannot find a method defined in an object's class definition it will look in the definition of the class's subclasses.

Answer: False

43. If the Java compiler cannot find a method defined in an object's class definition it will look in the definition of the class's superclass.

Answer: True

44. Java supports double inheritance, i.e., a class can have more than one superclass.

Answer: False

45. Java supports single inheritance only, i.e., a class can only directly inherit from a single superclass.

Answer: True

46. Subclasses are assignment compatible with the superclasses above them in the inheritance hierarchy.

Answer: True

47. A *package* can be split among several files.

Answer: True

48. A compilation unit can contain more than one *public* class.

Answer: False

Multiple Choice

49. Inheritance is ______________________ .

A. an organizational mechanism
B. a reuse mechanism
C. a means to create a new class from an existing class
D. a way to define an “is-a” hierarchy of classes
E. all of the above

Answer: E

Fill-in-the-Blank

50. The ________________ method of the Object class returns a string representing some of the internal system implementation details of the object.

Answer: *toString*

51. The Java reserved word _________________ indicates inheritance, i.e., we code *class subclass* ______________ *superclass*.

Answer: extends

52. To access the contents of a package from within a program, you must ___________ the package into your program (answer with a Java reserved word).

Answer: *import*

Short Answer

53. Explain the statement: “Subclasses are assignment compatible with the superclasses above them in the inheritance hierarchy.”

Answer: This means that an object of the subclass can be assigned to a variable that is declared to be of the superclass type. The subclass object is-a superclass object. But not the other way around.

54. Describe some of the advantages of Java packages.

Answer: They let us organize our files. They can be compiled separately and imported into our programs. They make it easier for programs to use common class files. They help us avoid naming conflicts.

55. What is the result of placing the following import statement in your program?

import package1.;*

Answer: All of the classes in the *package1* package will be usable from within your program.

Section 1.5: Data Structures

True / False

56. A stack is a first in, first out structure.

Answer: False

57. A queue is a first in, first out structure.

Answer: True

58. True or False? An array whose elements are sorted is a sorted list.

Answer: True

59. True or False? A tree element can only have one successor.

Answer: False

60. True or False? A tree child element can only have a single parent.

Answer: True

Multiple Choice

61. Which of the following structures did we classify as “implementation dependent”?

A. Sorted List
B. Graph
C. Linked List
D. Tree
E. None of these

Answer: C

62. This structure is “last in, first out”.

A. Array
B. Linked List
C. Stack
D. Queue
E. Tree

Answer: C

63. This structure is “first in, first out”.

A. Array
B. Linked List
C. Stack
D. Queue
E. Tree

Answer: D

64. Which of the following structures did we classify as “non-linear”?

A. Array
B. Stack
C. Queue
D. Sorted List
E. Tree

Answer: E

Fill-in-the-Blank

65. The array and the __________________ act as building blocks for many other structures.

Answer: linked list

66. A _____________ is made up of a set of elements, usually called nodes or vertices, and a set of edges that connect the vertices, with no restrictions on the connections between the elements.

Answer: graph

Short Answer

67. What is the difference between the tree structure and the graph structure?

Answer: Unlike with trees, there are no restrictions on the connections between elements in a graph.

Section 1.6: Basic Structuring Mechanisms

True / False

68. An alias is when we have two objects of the same class.

Answer: False

69. An alias is when we have two variables referring to the same object.

Answer: True

70. The following code results in garbage being created.

```
Circle c1 = new Circle(8);
Circle c2;
```

Answer: False

71. The following code results in garbage being created.

```
Circle c1 = new Circle(8);
Circle c2;
c2 = c1;
```

Answer: False

72. The following code results in garbage being created.

```
Circle c1 = new Circle(8);
Circle c2 = new Circle(5);
c2 = c1;
```

Answer: True

73. The Java run time systematically removes garbage from the system.

Answer: True

74. All Java method arguments are passed “by value”.

Answer: True

75. All Java method arguments are passed “by reference”.

Answer: False

76. When an object variable is passed as an argument to a method, an alias of the object is created.

Answer: True

77. Arrays in Java are a primitive type.

Answer: False

78. Arrays of objects are supported by Java.

Answer: True

Multiple Choice

79. The following is a “reference” type.

A. int
B. long
C. boolean
D. String
E. none of these

Answer: D

80. In Java, method arguments are passed by

A. value
B. reference
C. creating a copy of the argument and passing it
D. using an array
E. none of these

Answer: A

Fill-in-the-Blank

81. Java uses the reserved word _____________ to indicate an “absence of reference”.

Answer: null

82. When we assign one object to another object, using =, we say we have created a(n) __________.

Answer: alias

83. During _________________________ the system returns space that has been allocated but can’t be used to the free pool of space.

Answer: garbage collection

Short Answer

84. What are the two basic structuring mechanisms described in the textbook?

Answer: The reference and the array

85. What is the difference between the following two Java statements:

```
Circle circleA;

Circle circleA = new Circle(5);
```

Answer: The first statement reserves memory space for a variable of class *Circle* named *circleA*. The second statement does the same thing, but also creates an object of class *Circle* and places a reference to that object in the memory space of the *circleA* variable.

86. Describe an important difference between how Java handles primitive variables, such as int, and non-primitive variables, such as String.

Answer: Primitive types are handled “by value”, meaning that a variable of a primitive type holds the value of the variable. Non-primitive types are handled “by reference” meaning that a variable of a non-primitive type holds a reference to the value of the variable, i.e., it holds the address where you can find the value associated with the variable.

87. Using the *IncDate* class defined in the textbook, what is the output from the following code;

```
Date date1 = new IncDate(1, 2, 2005);   //  1/2/2005
Date date2 = new IncDate(4, 1, 2006);   //  4/1/2006
date2 = date1;
date2.increment();
System.out.println(date1 + “ – “ + date2);
```

Answer: 1/3/2005 – 1/3/2005

88. Using the *IncDate* class defined in the textbook, what is the output from the following code;

```
Date date1 = new IncDate(1, 2, 2005);
Date date2 = new IncDate(1, 2, 2005);
if (date1 == date2)
{
  System.out.println(“equal”);
}
else
{
  System.out.println(“not equal”);
}
```

Answer: not equal

89. Using the *IncDate* class defined in the textbook, what is the output from the following code;

```
Date date1 = new IncDate(1, 2, 2005);
Date date2 = new IncDate(1, 2, 2005);
date1 = date2;
date1.increment();
if (date1 == date2)
{
  System.out.println(“equal”);
}
else
{
  System.out.println(“not equal”);
}
```

Answer: equal

Section 1.7: Comparing Algorithms: Big-O Analysis

True / False

90. N^3 +4N is O(4N)

Answer: False

91. $3N^3 + 5N^2$ + 27N +17 is $O(N^3)$

Answer: True

92. $N^4 + 10N^3$ is $O(N^3)$

Answer: False

Multiple Choice

93. Which of the following represents “exponential” time

A. O(2N)
B. $O(N^2)$
C. $O(2^N)$
D. $O(N^9)$
E. None of these

Answer: C

Short Answer

94. What is the order of magnitude of the following function, using Big-O notation: $3N^4 + 17N^2$?

Answer: $O(N^4)$

95. What is the order of magnitude of the following function, using Big-O notation: $N^2 + 3N\log_2 N$?

Answer: $O(N^2)$

96. What is the order of magnitude of the following function, using Big-O notation: (N * (N + 3) * 2N) / 10 ?

Answer: $O(N^3)$

97. Describe the order of magnitude of the following code section using Big(O) notation.

```
count = N;  j = 0;
for (i = count; i > N; i--)
  j = j + 1;
```

Answer: O(1)

98. Describe the order of magnitude of the following code section using Big(O) notation.

```
count = 1;  j = 0;
for (i = count; i < N; i++)
  j = j + 1;
```

Answer: O(N)

99. Describe the order of magnitude of the following code section using Big(O) notation.

```
k = 0;
for (i = 0; i < N; i++)
  for (j = (N / 2); j > 0; j--)
    k = k + 1;
```

Answer: $O(N^2)$

100. Describe the order of magnitude of the following code section using Big(O) notation.

```
k = 0;
for (i = 0; i < N; i++)
  for (j = (2 * N); j > 0; j--)
    k = k + 1;
```

Answer: $O(N^2)$

101. Describe the order of magnitude of the following code section using Big(O) notation.

```
j = 1;
While (j < N)
{
  j = j * 2);
}
```

Answer: $O(\log_2 N)$