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CS253: Software development and Operations

End Semester Examination

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Instructions:

1. The questions are of MCQ type.
2. Each question has one or more correct answers. To get credit for a question, you have to select the exact set of all the correct answers.
3. Please mark your answers clearly in the Bubble Sheet. Please write your name (in Block Capital) and roll number clearly.

Q 1: (1 point)

Which of the following are the advantages of the `agile processes` over the `plan-driven processes`?

(A) Project management is easy

(B) Overhead for maintaining the specification and design document is less

(C) Changes in the requirements are easy to tackle

(D) System certification is easier to achieve

Q 2: (1 point)

Consider the following two statements about the functional requirements:

S1: If the functional requirements for a system are `complete`, then the requirements must be `consistent`.
S2: If the functional requirements for a system are `consistent`, then the requirements must be `complete`.

Which of the following is true?

(A) Only S1 is correct

(B) Only S2 is correct

(C) Both S1 and S2 are correct

(D) Neither S1 nor S2 is correct

Q 3: (1 point)

Consider a web service like Gradescope where a student can check her grade for a subject by logging into the system using her user ID and password.

Now consider the following property: ***Student A should not be able to see the grade of student B by logging into the system.***

This property belongs to which of the following classes of properties/requirements?

(A) Safety

(B) Confidentiality

(C) Integrity

(D) Availability

(E) Security

Q 4: (1 point)

Test Case generation is a requirement validation technique. Which of the following requirement validation checking is carried out by test case generation?

(A) Consistency

(B) Completeness

(C) Realism check

(D) Verifiability

Q 5: (1 point)

Suppose a requirement about the behavior of a robotic system has been captured in `Linear Temporal Logic`. This specification falls under with of the following classes of specifications?

(A) Natural language specifications

(B) Structured natural language specifications

(C) Specifications using graphical notations

(D) Mathematical specifications

Q 6: (1 point)
Which of the following UML diagrams deal(s) with the behavior of exactly one object?

(A) Use-case diagram
(B) Class diagram
(C) Sequence diagram
(D) State Diagram

Q 7: (1 point)
Consider the following class diagram:

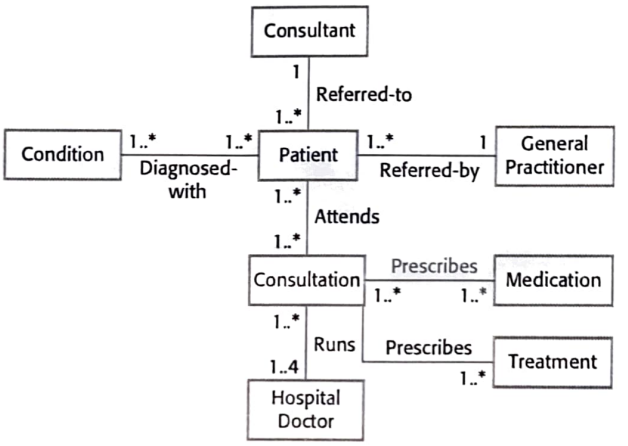

Figure 1: Classes for a patient management system

In the patent management system represented by the above class diagram, a `hospital doctor` can be involved in at most how many `consultations`?

(A) 0
(B) 1
(C) 4
(D) No restriction

Q 8: (1 point)
Suppose you have a base (parent) class `shape` and two derived (children) classes `polygon` and `circle`. Which of the following attributes are suitable to be included in the base class "shape"?

(A) Area
(B) Perimeter
(C) Number of sides
(D) Radius

Q 9: (1 point)
Consider the following C++ program:

```
#include<iostream>
using namespace std;

class Shape {
   long area;
};

int main() {
  Shape s;
  s.area = 100;
  cout << s.area << endl;
  return 0;
}
```

What will happen when you attempt to compile and run this program?

(A) The compiler will throw an error

(B) The compilation will be successful but there will be a runtime error during execution

(C) 100 will be printed as the output

(D) Compilation will be successful and the execution will terminate without printing any value

Q 10: (1 point)

Consider a class `Circle` with a private variable `radius` of type `double`, which of the following is/are correct declaration of a constructor function?

(A) `Circle()`

(B) `void Circle(double r)`

(C) `double Circle(double r)`

(D) `Circle(double r)`

Q 11: (1 point)

Consider the following C++ program:

```
#include <iostream>
using namespace std;

class Shape {
  private:
    int width;
    int height;
  public:
    void setWidth(int w) {
      width = w;
    }
    void setHeight(int h) {
      height = h;
    }
};

class Rectangle: public Shape {
  public:
```

```
    int getArea() {
      return (width * height);
    }
};

int main(void) {
  Rectangle Rect;
  Rect.setWidth(5);
  Rect.setHeight(7);
  cout << "Total area: " << Rect.getArea() << endl;
  return 0;
}
```

What will happen when you attempt to compile and run this program?

(A) The compiler will complain about using private variable of class `Shape` in the class `Rectangle`

(B) The compiler will complain about calling a member function of class `Shape` with an object of class `Rectangle`

(C) The compilation will be successful but there will be a runtime error during execution

(D) The following will be printed as output:
`Total area: 35`

Q 12: (1 point)
Suppose you want to define a *pure virtual function* `perimeter` for a class `Polygon`. Which of the following is the correct declaration of the function?

(A) `virtual double perimeter();`

(B) `pure virtual double perimeter();`

(C) `virtual double perimeter() = 0;`

(D) `virtual double Polygon::perimeter();`

Q 13: (1 point)
Consider the following C++ program:

```
#include <iostream>
using namespace std;

int main()
{
        int x = -1;
        try {
                cout << "Inside try \n";
                if (x < 0)
                {
                        cout << "Exception detected" << endl;
                        throw x;
                        cout << "Exception thrown" << endl;
                }
        }
        catch (...) {
                cout << "Exception caught" << endl;
```

```
        }
        cout << "After catch \n";
        return 0;
}
```

What will happen when you attempt to compile and run this program?

(A) Compilation Error

(B) The following output on the terminal:

```
Inside try
Exception detected
Exception thrown
Exception caught
After catch
```

(C) The following output on the terminal:

```
Inside try
Exception detected
Exception caught
After catch
```

(D) The following output on the terminal:

```
Inside try
Exception caught
After catch
```

Q 14: (1 point)

Consider the following C++ program:

```
#include <iostream>
using namespace std;

class printData {
  public:
    void print(int i) {
      cout << "Printing int: " << i << endl;
    }
    void print(double f) {
      cout << "Printing float: " << f << endl;
    }
    void print(char* c) {
      cout << "Printing character: " << c << endl;
    }
};

int main(void) {
  printData pd;
  pd.print(5);
  pd.print(500.263);
  pd.print("Hello C++");
  return 0;
}
```

Which of the following object oriented programming concepts have been used in the above program?

(A) Operator overloading
(B) Function overloading
(C) Virtual function
(D) Friend function

Q 15: (1 point)
Suppose that the `ls` command on the terminal produces the following output:

---

file1.txt

What will be the output on the screen after executing the following command ?
`ls file1.txt file2.txt &> out`

(A) `file1.txt`
(B) `ls: file2.txt: No such file or directory`
(C)
```
ls: file2.txt: No such file or directory
file1.txt
```
(D) No output on the screen

Q 16: (1 point)
Cosider a file named `fruits` containing the following contents:

```
apple
orange
guava
watermelon
banana
mango
jackfruit
pineapple
```

The following command is executed in the same directory containing the file `fruits` on the command prompt:

`cat fruits | grep "an" | sort`

Which of the following is/are true about the output produced after the execution of the command?
(A) Nothing is printed on the screen
(B) The names of eight fruits are printed with one fruit on one line and `banana` on the second line
(C) A list of fruit names is printed with one fruit in one line and `banana` on the first line
(D) The number of names of thee fruits printed on the screen is less than 8

Q 17: (1 point)
Suppose you want to ensure that the value of a variable `sum` should never be greater than 1000 at some location in your code written in C++. Which one of the following is the correct assert statement to be placed at that location?
(A) `assert` (1000)
(B) `assert` ($sum < 1000$)
(C) `assert` ($sum \leq 1000$)
(D) `assert` ($sum \geq 1000$)

Q 18: (1 point)

Consider the following makefile name `Makefile`. Assume that the `.cpp` and `.h` files mentioned in the Makefile are available in the same directory.

```
shaper: shape.o rect.o main.o
        g++ -o shaper shape.o rect.o main.o

shape.o: shape.h shape.cpp
        g++ -c shape.cpp

rect.o: shape.h rect.h rect.cpp
        g++ -c rect.cpp

main.o: shape.h rect.h main.cpp
        g++ -c main.cpp


.PHONY: clean
clean:
        rm -f shape.o
        rm -f rect.o
        rm -f main.o
        rm -i shaper
```

You issue the command `make` to build the executable file `shaper`. Subsequently, you modify `rect.cpp` and run the command `make` again. Which of the following commands will get executed during the second execution of the `make` command?

(A) `g++ -o shaper shape.o rect.o main.o`

(B) `g++ -c shape.cpp`

(C) `g++ -c rect.cpp`

(D) `g++ -c main.cpp`

Q 19: (1 point)

Which of the following captures the correct order of different testing activities?

(A) unit testing → integration testing → system testing → alpha testing → beta testing

(B) alpha testing → unit testing → integration testing → system testing → beta testing

(C) unit testing → system testing → integration testing → alpha testing → beta testing

(D) unit testing → integration testing → system testing → release testing → acceptance testing

Q 20: (1 point)

Consider the following function:

```
int function(int a, int b) {
    int x;
    x = a + b;
    return x;
}
```

Which of the following is/are test case(s) for the above function?

(A) $a = 10, b = 5, x = 15$

(B) $a = 10, b = -5, x = 15$

(C) $a = 10, b = 5$

(D) $a = 0, b = 0, x = 0$

Q 21: (1 point)

Consider the following function:

```
int function(int a, int b) {
    int x, y;
    x = a + b;
    if (x > 0)
    {
        a = a - 1;
    }
    else
    {
        b = b + 1
    }
    y = a - b;
    return y;
}
```

How many test cases are required for complete statement coverage of the function?

(A) 1

(B) 2

(C) 4

(D) 8

Q 22: (1 point)

Consider the following function:

```
int function(int a, int b) {
    int y;
    If (a > 5) || (b > 5)
        y = a + b;
    else
        y = a - b;
    return y;
}
```

Now consider the following test suite: $\{\langle a = 10, b = 1; y = 11\rangle, \langle a = 1, b = 1; y = 0\rangle\}$.

This test suite provides 100% coverage with respect to which of the following criteria?

(A) Statement coverage

(B) Decision coverage

(C) Condition coverage

(D) Decision/Condition coverage

Q 23: (1 point)
The task of debugging involves which of the following activities?

(A) Detect that an error is present in the code

(B) Identify the root cause of an error

(C) Eliminate the root cause of the error

(D) Run the regression test suite

Q 24: (1 point)
Which of the following things are not necessary in Python?

(A) Variable declaration

(B) Line termination using semicolon

(C) Indentation

(D) Starting and closing blocks using curly braces

Q 25: (1 points)
Choose the correct output of the following python code.

```
class Fruit:
    def __init__(self,color,size):
        self.name='fruit'
        self.color=color
        self.size=size

    def show(self):
        print("this is "+str(self.name)+" of color"+str(self.color))

apple = Fruit('red',3)

class Orange(Fruit):
    def __init__(self,color):
        self.name='fruit'
        self.color=color

    def show(self):
        print("It is Orange "+str(apple.color))

class Apple(Fruit):
    def show(self):
        print("It is Apple "+str(self.color))

a = Apple("red",3)
o = Orange("yellow")
a.show()
o.show()
```

(A) It is Apple red
It is Orange red

(B) It is Apple red
It is Orange yellow

(C) `It is Apple yellow`
`It is Orange yellow`

(D) `It is Apple yellow`
`It is Orange red`

Q 26: (1 points)
With respect to the MVT architecture of the Django framework, which of the following are correct?
(A) Templates are always rendered with a context
(B) Models in django are of class type
(C) View in django are of function type
(D) Using django ORM helps us use SQL in a more systematic way

Q 27: (1 point)
What will be the value of a after the execution of the following Python program?

```
import numpy as np
Input : a =  np.arange(10).reshape((2,5,1))
Output: a = np.reshape(np.flip(a), a.shape[:-1])
```

(A) `[[[9], [8], [7], [6], [5]], [[4], [3], [2], [1], [0]]]`
(B) `[[[4], [3], [2], [1], [0]], [[9], [8], [7], [6], [5]]]`
(C) `[[9, 8, 7, 6, 5], [4, 3, 2, 1, 0]]`
(D) `[[4, 3, 2, 1, 0], [9, 8, 7, 6, 5]]`

Q 28: (1 point) Let a be a NumPy array with shape (12,). Which of the following codes will result in reshaping the array to (4, 1, 3)?

(A)

```
np.expand_dims(np.reshape(a, (4,3)), axis=1)
```

(B)

```
a = np.reshape(a, (4,3))
a = a[:, np.newaxis, :]
```

(C)

```
a = np.reshape(np.reshape(a, (3,4)), (4,1,3))
```

(D)

```
a = np.expand\_dims(np.reshape(a, (4,3)), axis=-1)
```

Q 29: (1 point)

Let $\mathcal{D} = \{x_1, x_2, \ldots, x_n\}$ be the dataset to be clustered using K-means algorithm. Let $\mathcal{C} = \{c_1, c_2, \ldots, c_k\}$ be the means of k clusters and γ_i be the index of the cluster assigned to x_i. Also, $\mathbb{1}[y == p]$ represents the indicator function which is 1 iff $(y = p)$ else it is 0. Then, which of the following represents an iteration of the K-means algorithm?

(A) (A) $\forall x_i \in \mathcal{D}, \gamma_i = \arg\min_j(||x_i - c_j||^2)$
$\forall j \in \{1, 2, ..., k\}, c_j = \frac{1}{\sum_{i=1}^{n} \mathbb{1}[\gamma_i == j]}(\sum_{i=1}^{n} \mathbb{1}[\gamma_i == j] \cdot x_i)$

(B) $\forall x_i \in \mathcal{D}, \gamma_i = \arg\min_j(x_i - c_j)$
$\forall j \in \{1, 2, ..., k\}, c_j = \frac{\sum_{i=1}^{n} x_i}{n}$

(C) $\forall x_i \in \mathcal{D}, \gamma_i = \arg\min_j(||x_i - c_j||^2)$
$\forall j \in \{1, 2, ..., k\}, c_j = \frac{\sum_{i=1}^{n} x_i}{n}$

(D) $\forall x_i \in \mathcal{D}, \gamma_i = \min_{j=1}^{k}(||x_i - c_j||^2)$
$\forall j \in \{1, 2, ..., k\}, c_j = \frac{\sum_{i=1}^{n} \gamma_i x_i}{\sum_{i=1}^{n} \gamma_i}$

Q 30: (1 point)

Which of the following tools are used for software testing?

(A) GoogleTest

(B) Trello

(C) Postman

(D) JUnit