

NAME : *answers*

The exam is closed book, no notes and no computer.

All your answers to the questions below must be submitted on paper.

Write your name on this sheet and submit it with your answers.

Please do not ask questions during the exam.

1. A company has a sales and a customer service department. Both departments bill the customers for sold goods and rendered services. In setting up the software for the billing of the customers, there are two possible ways to organize the modules.
 - (a) Each department, sales and services, has its own billing module.
 - (b) There is only one billing module to support both the sales and the services.

Which of the two designs is best?

Justify your choice by application of the key principles of good modular design.

answer: Design (b) is best.

- (a) Information hiding: the billing department is concerned with financial transactions with customers. Sensitive data such as credit card information is better handled in one place, instead of at many departments.
 - (b) High cohesion and low coupling: to issue a bill and to collect the funds does not required special knowledge about the goods sold or the services rendered, so we maintain low coupling by having one billing department that is separate from the others. There is high cohesion because the specific tasks of handling bills is located in one department.
 - (c) Design for change: prices are most likely to change, but these decisions remain local to the sales and services departments.
2. What is a polynomial time algorithm? Give an example of such an algorithm.

answer: In a polynomial time algorithm, the cost of the operations grows polynomial in the dimension of the problem. For example, the cost of adding a sequence of n numbers is linear in n . If we double the length of the sequence, then the cost also doubles.

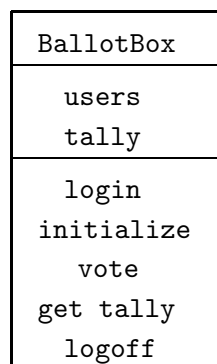
3. Write a function to prompt the user for a dollar amount in the format `d.dd` where `d` is a decimal representation of a natural number in the range from 0 to 9, 0 and 9 included. As long as the user fails to enter this amount, the user is asked to retry. The function returns the entered number as a float.

answer:

```
def prompt():
    """
    Prompts the user for a number in the format d.dd.
    """
    while True:
        nbr = input('Give a dollar amount : ')
        try:
            parts = nbr.split('.')
            dollar = int(parts[0])
            assert(dollar >= 0 and dollar <= 9)
            assert(len(parts[1]) == 2)
            cents = int(parts[1])
            assert(cents >= 0 and cents <= 99)
            return dollar + cents/100
        except:
            print('Incorrect format, please try again.')
```

4. Consider the `BallotBox` class which represents the number of votes in favor or against a certain motion. There are two types of users of the `BallotBox`: `Voter` and `Clerk`. Voters vote, after identifying themselves with a login. After voting, a voter logs off. A clerk initializes the `BalloxBox` and retrieves the tally of the votes, in favor or against the motion. Draw the class diagram for the `BalloxBox`.

answer:



5. For an event, there are three types of passes: front, center, and upper, depending on the location of the seating area. The passes contain the name of the participant and the type of seating. To model a pass, define a class `EventPass`. An object of this class stores the name of the participant and the type of the pass. The string method returns the statement which contains the name of the participant and the type of the pass. Write Python code for the constructor and the string method.

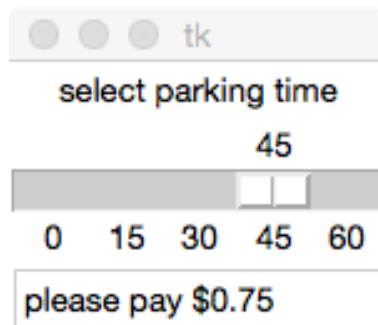
answer:

```
class EventPass(object):
    """
    Models an event pass.
    """
    def __init__(self, name, passtype):
        """
        Stores the name and type of the pass.
        """
        self.name = name
        self.type = passtype

    def __str__(self):
        """
        Returns the string representation.
        """
        result = self.name + ' holds a pass of type ' \
            + self.type + '.'
        return result
```

6. A parking meter allows the user to buy parking time: 25 cents for 15 minutes, with an upper limit of one hour. Draw a GUI for a parking ticket dispenser. For each widget, write one complete sentence to explain its working.

answer:



There are three widgets:

- The label widget tells the user what to do.
- The scale widget lets the user to select the parking time.
- The entry widget presents the bill to the user.

7. Explain the difference between a thread and a process. Illustrate with an example.

answer: The main difference between a thread and a process is that threads share internal memory while processes do not share internal memory. Within a process many threads may run. An example of a process is the running of the Python interpreter. Within a Python process, with the Thread class we can define and start multiple threads.