ICT162

Object Oriented Programming

Classes

- **Face-to-Face**

- 6 x 3 hrs per seminar: practical sessions

- **Online Office Hours**

- 6 x 2 hrs per office hour: discussion sessions

- **Distance learning style**

- Study Guide

- Self reading and practice required

Sessions

- 6 seminar sessions covering
  - Class and Objects
  - Composition
  - Inheritance
  - Collection
  - Exception Handling
  - Graphical User Interface
  - SOLID principles

Assessment

Assessment	Description	Weight Allocation
PCQ	3 Pre-class Quizzes	6%
On-line Quiz		6%
TMA	Tutor-Marked Assignment	18%
Total Continuous Assessment		30%
Examination	ECA (Take home exam)	70%
	TOTAL	**100%**

- To be sure of a pass result, you need to achieve scores of 40% in each component.
- TMA – 12 hours grace period. Thereafter 10 marks per day.

Important Points to Remember

1. Mark Deduction for Late Submissions of Tutor-Marked Assignments (TMA):
   - The assignment submission due date is specified on the TMA. The deadline time is 2355 hours on the due date.
   - No extension can be given to TMA cutoff dates

2. Successful submission of TMAs:
   - Upon successful submission, you should see a receipt number on the screen. Please take note of this receipt number as proof of your TMA submission.

Important Points to Remember

3. Ensure that the correct file naming convention is adopted for TMAs:
   - Refer to the MyUniSIM Student Guide (pages 6 & 7)

4. Collusion in Assignments (TMA) :
   - A serious academic offence. Turnitin will flag all instances of copying done in assignments.
   - TMA is an individual assignment so it should be a students own work

Important Points to Remember

5. Correspondence with SUSS using MyMail account:
   - We will only accept correspondences sent from you using your SUSS MyMail account (xxxx@suss.edu.sg).

6. Approach Student Relations Department for assistance:
   - Call 6248 9111, press “2”.
   - or email to lssupport@suss.edu.sg

Seminar 1

Class and Objects

Unit 1

Object Oriented Programming

- Models after real life situations

- Put all related data (variables) and behaviour (methods) together (Abstraction)

- Hides details but expose interface to interaction through only method call (Encapsulation)

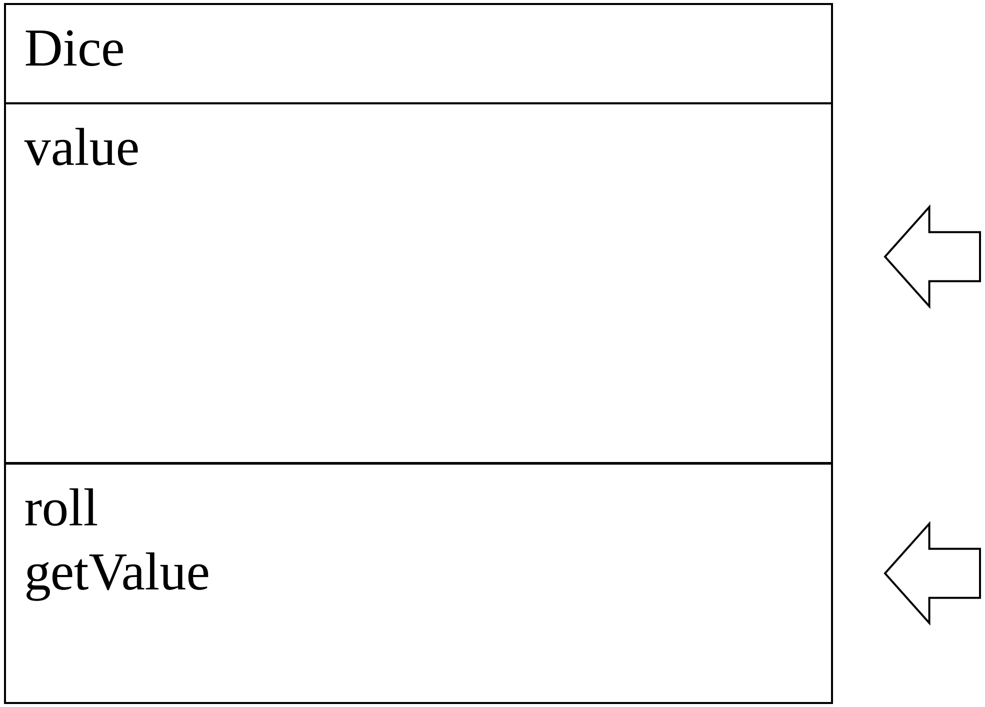
Object Oriented Programming

- Class is a structure that defines
  - all related variables belonging to a entity.
  - all related methods that process the variables

  Only a template, actual object not created yet

- Objects or instances are ***actual*** entities
  - Object = identity + instance variables + methods

Basic Structure of a Class



Dice

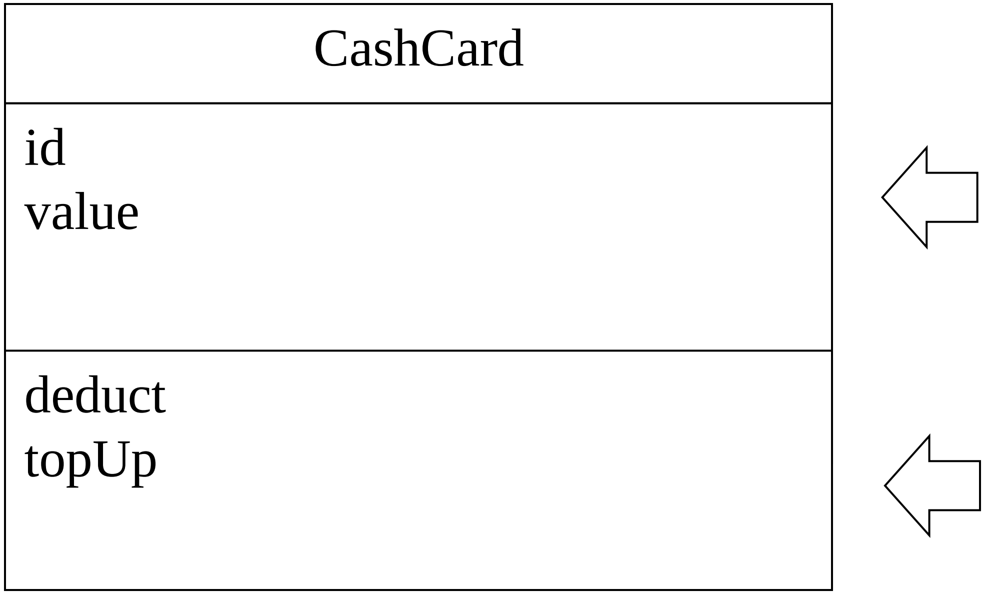
value

roll
getValue

Attributes, properties, characteristics, description

Capabilities, services, behaviour, functions, operations

Another Example



CashCard

id
value

deduct
topUp

Attributes, properties, characteristics, description

Capabilities, services, behaviour, functions, operations

Writing a Class

```
class className:
    constructor


    accessor or getter methods
    mutator or setter methods


    other methods
```

Constructor

```
from random import randint
class Dice:
    def __init__(self):
        self.__value = randint(1,6)
```

- initializes the values of instance variables

  Note: Include only Instance variables relevant to application

- __ (double underscore or dunder)

  private or hidden outside the class definition

Constructor and Instance Variables

```
class CashCard:
    def __init__(self, id, amount):
        self.__id = id
        self.__balance = amount
```

Creating objects

```
d1 = Dice()
d2 = Dice()
```

```
class Dice:
    def __init__(self):
```

```
c1 = CashCard('123', 20.0)
c2 = CashCard('456', 10.0)
```

```
class CashCard:
    def __init__(self, id, amount):
```

In the same order as the constructor parameters

Accessor or Getter methods

```
from random import randint
class Dice:
    def __init__(self):
        self.__value = randint(1,6)

    @property
    def value(self):
        return self.__value
```

Accessor or Getter methods

```
class CashCard:
    def __init__(self, id, amount):
        self.__id = id
        self.__balance = amount

    @property
    def id(self):
        return self.__id

    @property
    def balance(self):
        return self.__balance
```

Mutator or Setter methods

```
from random import randint
class Dice:
    def __init__(self):
        self.__value = randint(1,6)

    @property
    def value(self):
        return self.__value

    @value.setter
    def value(self, newValue):
        self.__value = newValue
```

It is unlikely that a Dice object has this setter method though!!!

Mutator or Setter methods

```
class CashCard:
    def __init__(self, id, amount):
        self.__id = id
        self.__balance = amount

    @property
    def id(self):
        return self.__id

    @property
    def balance(self):
        return self.__balance
```

```
@id.setter
  def id(self, newId):
      self.__id = newId

  @balance.setter
  def balance(self, newBalance):
      self.__balance = newBalance
```

It is unlikely that a CashCard object has these setter methods though!!!

Calling accessor and mutator methods

```
print(d1.value, d2.value)
```

```
d1.value = 50
```

```
@property
   def value(self):
       return self.__value

   @value.setter
   def value(self, newValue):
       self.__value = newValue
```

Calling accessor and mutator methods

```
print(c1.id, c2.id)

print(c1.balance, c2.balance)
```

```
@property
   def id(self):
       return self.__id
   @property
   def balance(self):
       return self.__balance
```

```
c1.id = '878'

c2.balance = 100
```

```
@id.setter
   def id(self, newId):
       self.__id = newId

   @balance.setter
   def balance(self, newBalance):
       self.__balance = newBalance
```

Other methods - Behaviour

```
from random import randint
class Dice:
    def __init__(self):
        self.__value = randint(1,6)

    @property
    def value(self):
        return self.__value

    def roll(self):
        self.__value = randint(1,6)

    def __str__(self):
        return 'Value: {}'.format(self.__value)
```

Other methods - Behaviour

```
class CashCard:
    def __init__(self, id, amount):
        self.__id = id
        self.__balance = amount

    @property
    def id(self):
        return self.__id

    @property
    def balance(self):
        return self.__balance
```

```
def deduct(self, amount):
        if self.__balance >= amount:
            self.__balance -= amount

def topUp(self, amount):
        if amount > 0:
            self.__balance += amount

def __str__(self):
        return 'Id: {} Balance: ${:.2f}'.format(self.__id, self.__balance)
```

Usually returns the attribute values as a str

Sending message to object

Format: object.*message*(parameters)

```
aDice = Dice()

aDice.roll()
print(aDice.value)
```

```
myCard = CashCard(“123”, 10.0)

myCard.deduct(2.5)
myCard.topUp(10.0)
print(myCard.balance)
```

Calling __str__ method

Rather than

```
print(aDice.__str__())
```

Simply

print(aDice) or

print(str(aDice)) for string operation

Method overloading - Default parameters

```
class CashCard:
    def __init__(self, id, amount = 20):
        self.__id = id
        self.__balance = amount

 def deduct(self, amount = 5):
        if self.__balance >= amount:
            self.__balance -= amount

 def topUp(self, amount=10):
        if amount > 0:
            self.__balance += amount
```

```
c1 = CashCard("123", 10.0)
c2 = CashCard("124")

c1.deduct(2.5)
c1.deduct()

c1.topUp(5)
c1.topUp()
```

Class variables

- Class variables
  - variables defined in a class outside methods
  - There is only 1 copy of this variable during execution versus the many copies of instance variables for every object instantiated
- For example, the Dice class records the number of sides its object has.

Class Variables and Methods

```
from random import randint
class Dice:
    __sides = 6

    @classmethod
    def getSides(cls):
        return cls.__sides

    @classmethod
    def setSides(cls, sides):
        cls.__sides = sides

    def __init__(self):
        self.__value = randint(1, type(self).getSides())
```

To get__sides:
Dice.getSides()

To set __sides:
Dice.setSides(10)

```
    @property
    def value(self):
        return self.__value

    def roll(self):
        self.__value = randint(1, \
                type(self).getSides())

    def __str__(self):
        return 'Value: {}'.format.\
                (self.__value)
```

Class variable – CashCard Example

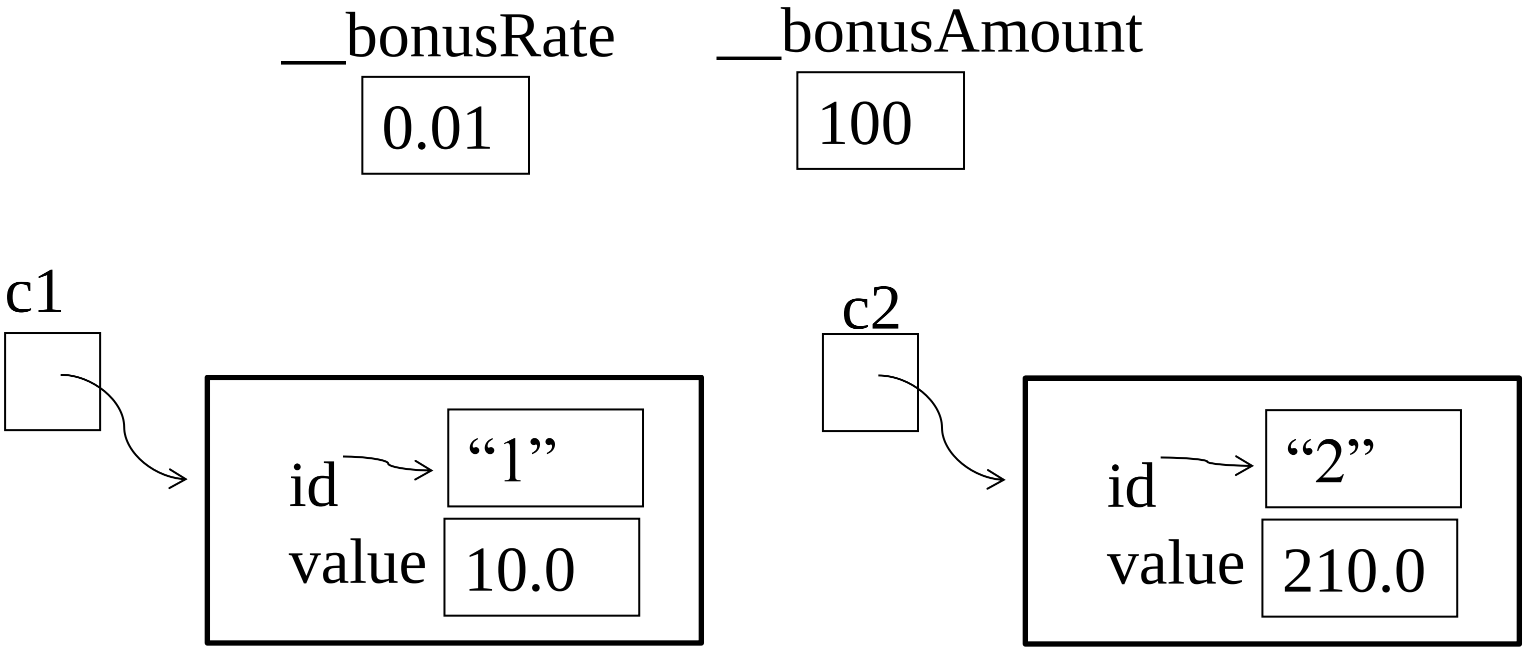
- For a top up amount of 100 dollars or more, the cash card gets an additional 1% in value.

- 1% applies to top ups for all cash card
  - should not be an instance variable of every CashCard object

```
class CashCard:
    __bonusRate = 0.01
    __bonusAmount = 100

    def __init__(self, id, amount):
        self.__id = id
        self.__balance = amount
        self.addBonus(amount)

    def addBonus(self, amount):
        if amount >= type(self).__bonusAmount :
            self.__balance += amount * type(self).__bonusRate

    def topUp(self, amount):
        if amount > 0:
            self.__balance += amount
            self.addBonus(amount)
```

Class variables

```
c1 = CashCard(“1”, 10.0)
c2 = CashCard(“2”, 200.0)
```



__bonusRate

0.01

__bonusAmount

100

c1

id “1”

value 10.0

c2

id “2”

value 210.0