## Question 1. True or False

Circle **T** if the statement is true, otherwise circle **F** if the statement is false.

1. A virtual function overloading an operator is an example of dynamic dispatch. **T** **F**

2. Dynamically typed interpreted language cannot implement early binding. **T** **F**

3. `decltype` in C++ is an example of static reflection. **T** **F**

4. The instance variables specified in the `__slots__` special variable must be initialized before they can be referenced. **T** **F**

5. You can call any method defined in the super class by replacing `self` with `super()` in the methods of a subclass. **T** **F**

6. You can overload the assignment operator in Python. **T** **F**

7. The `__str__` special method is an example of ad-hoc polymorphism. **T** **F**

8. The `__dict__` special attribute is an example of attribute reification. **T** **F**

9. A class method cannot be used to change instance variables. **T** **F**

10. If an attribute name starts with an underscore, it can only be accessed by instance methods of the same class. **T** **F**

## Question 2. Multiple Choices

Pick all answer(s) that are correct.

a) Which of the following functions in Python are examples of introspection?

i. `globals`

ii. `getattr`

iii. `setattr`

iv. `delattr`

v. `hasattr`

b) Given the following code snippet:

```
class A:
    foo = [1, 2]

x = A()
y = A()
```

Which one of the following statements are true? (Note: the previous statement do not affect the next)

i. After running `x.foo.append(3)`, the value of `y.foo` is `[1, 2, 3]`.

ii. After running `x.foo = [1, 2, 3]`, the value of `y.foo` is `[1, 2, 3]`.

iii. After running `A.foo = [1, 2, 3]`, the value of `y.foo` is `[1, 2, 3]`.

iv. After running `setattr(x, 'foo', [1, 2, 3])`, the value of `y.foo` is `[1, 2, 3]`.

v. After running `getattr(x, 'foo').append(3)`, the value of `y.foo` is `[1, 2, 3]`.

## Question 3. Short Questions

a) Describe type erasure, and its pros and cons.

b) Override the eat method in Animal so that the eat method in Dog will, *in addition to what* Animal.eat *already does*, print "Wags its tail" at the very end. Show the entire class definition for Dog.

```
class Animal:
   …
   # may change this function in the future
   def eat(self, food):
        print(str(food) + " is delicious")
```

c) Show that functions in Python are first-class citizens.

d) In Python, what is the difference between the class ‘function’ and the class ‘method’?

## Question 4. Programming Question

Create a Sheet class that works like a spreadsheet with a fixed dimension. The constructor should take 3 arguments, *width*, *height*, and *type*, which will create a *width* by *height* matrix filled with the default value of that type. For example:

```
>> sh = Sheet(3, 2, int)
>> print(sh)
0, 0, 0
0, 0, 0
```

The Sheet class must overload the index operator so that it takes a tuple of 2 elements in the form (*x*, *y*). If the value being set is not the type specified in the constructor, a `TypeError` must be raised. E.g.:

```
>> sh[2,1] = 5
>> sh[0,0] = 7
>> print(sh)
7, 0, 0
0, 0, 5
```

```
>> print(sh[1,1])
0
>> sh[0,1] = 3.2
TypeError: type must be int
```

Lastly, printing a Sheet object should output the matrix in comma separated format (see first example).