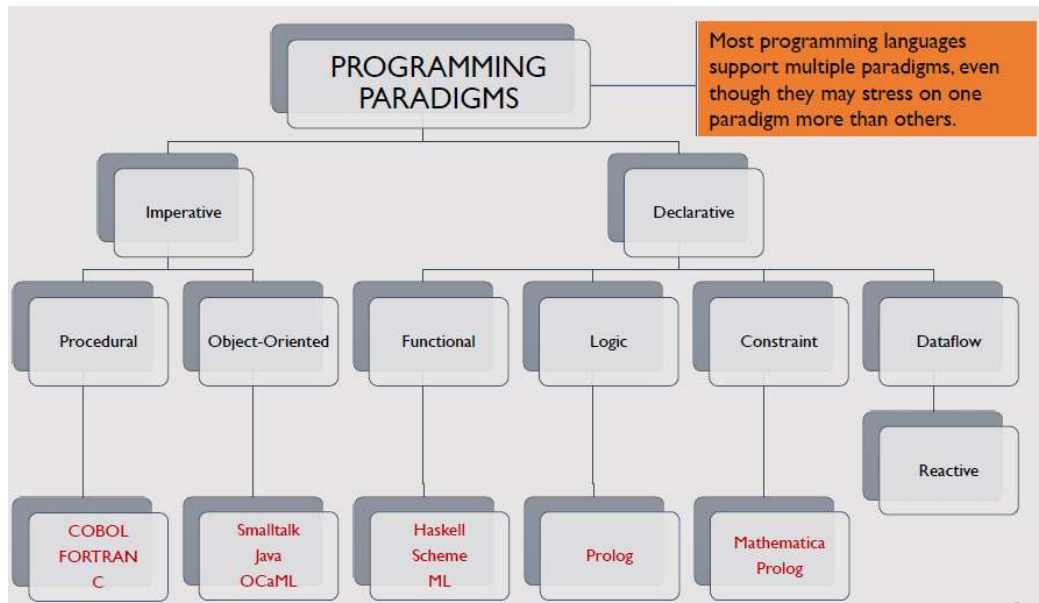# CSE216 – Programming Abstractions
End-term Review – Fall 2019

Q. 1: Programming languages spectrum, Python programming

A. Draw a hierarchical chart illustrating classification of programming paradigms. Show which paradigms are supported by following languages in the chart: Java, Python, SML, Javascript, HTML.

B. A small frog wants to get from one point to another point in a giant plane. The frog is currently located at position (X1, Y1) and wants to get to a position (X2, Y2). The small frog always jumps a fixed distance, D. Count the minimal number of jumps that the small frog must perform to reach its target.

Write a Python function `def MinFrogJumps (P, Q, D)` that, given two lists P and Q representing coordinates of starting position and ending position respectively and D representing jump distance, shows distance between two points (in a straight line) and returns the minimal number of jumps from position P1 to a position P2.

```
>>>MinFrogJumps([10, 15], [-2, -5], 5)

Distance between P1 and P2: 23.32

Minimum number of jumps: 5

import math

def MinFrogJumps (P1, P2, D):

    distance = math.sqrt(((P2[1])-(P1[1]))**2+((P2[0])-(P1[0]))**2)

    jumps = (distance/D)

    return ("Distance between P1 and P2: ", round(distance, 2)), ("Minimum number
of jumps: ", math.ceil(jumps))

print(MinFrogJumps([10, 15], [-2, -5], 5))
```

Q. 2: Names, scopes and bindings

Given the following code, show the status of subroutine stack separately for each individual step in the method call, method execution and method finish/return.

```
i = 20
j = 15
k = lcm(i,j)
print("LCM = ", k)
```

```
def gcd(x, y):
    """finds G.C.D. of two numbers"""
    while(y):
        x, y = y, x % y
    return x

def lcm(x, y):
    """returns the L.C.M. of two numbers"""
    lcm = (x*y)//gcd(x,y)
    return lcm
```

Finding LCM of 20 and 15

Finding GCD of 20 and 15   **(Refer to slides for the stack diagram)**

y = 5

y = 0

Returning GCD value 5

Returning LCM value 60

60

Q. 3. Data types

A. Specify the type system (strongly typed, weakly typed, statically typed or dynamically typed) for the following languages:

Language	*Type sytem*
C	**Statically typed**
Java	**Statically typed**
Python	**Dynamically typed**
SML	**Statically typed**
JavaScript	**Weakly typed**

B. What is the output of following Java code?

```
class OverridingDemo extends ABC{
   public void disp(){
      System.out.println("disp() method of Child class");
   }
   public void newMethod(){
      System.out.println("new method of child class");
```

```
    }
    public static void main( String args[]) {
        ABC obj = new ABC();
        obj.disp();
        ABC obj2 = new OverridingDemo();
        obj2.disp();
    }
}

class ABC{
    public void disp()
    {
        System.out.println("disp() method of parent class");
    }
}
```

Output:

_____ disp() method of parent class

_____ disp() method of Child class

C. What is the output of following Java code?
```
public class BoundedTypes {
    public static <T extends Comparable<T>> T function(T x, T y, T z) {
        T var = x;
        if(y.compareTo(var) > 0) {
            var = y;
        }
        if(z.compareTo(var) > 0) {
            var = z;
        }
        return var;
    }
    public static void main(String args[]) {
        System.out.printf("Function result is %d\n", function( 3, 4, 5 ));
        System.out.printf("Function result is %.1f\n", 6.6, 8.8, 7.7, function( 6.6,
8.8, 7.7 ));
        System.out.printf("Function result is %s\n",function("pear", "apple",
"orange"));
    }
}
```

Output:

_____ Function result is 5

_____ Function result is 5.5

_____ Function result is Pear

Q. 4. Subroutines, parameter passing, exception handling

What are coroutines? Give an example where it is beneficial to use coroutines.

Coroutines are execution contexts that exist concurrently, but that execute one at a time, and that transfer control to each other voluntarily and explicitly, by name.
As a simple application, consider a "screen-saver" program, which paints a mostly black picture on the screen of an inactive workstation, and which keeps the picture moving (to avoid phosphor or liquid-crystal "burn-in"), and also performs "sanity checks" on the file system in the background, looking for corrupted files.
coroutine check file system
for all files …
coroutine update screen
loop
update screen

A. What is the output of following Python code?

```python
def pass_list(xlist):
    xlist = [47, 42]

def change_list(xlist):
    xlist += [47, 42]

xlist = [1,2,3,4,5,6]
change_list(xlist)
print(xlist)
pass_list(xlist)
print(xlist)
```

Output:

_____ [1,2,3,4,5,6,47,42]

_____ [1,2,3,4,5,6,47,42]

B. What is the output of following Python code?

```python
def lessThan(cutoffVal, *vals) :
    arr = []
    for val in vals :
        if val < cutoffVal:
            arr.append(val)
    return arr

print(lessThan(10, 2, 17, -3, 42))
```

Output:

_____ [2, -3]

C. What is the output of following Python code?

```python
def foo(val1, val2, val3, calcSum=True):
    if calcSum:
        return val1 + val2 + val3
    else:
        return (val1 + val2 + val3) / 3

print(foo(10, 15, 20))
print(foo(10, 15, 20, calcSum=False))
```

Output:

_____ 45

_____ 15

Q. 5. Python programming

Write a class Patient that satisfies the following specifications:

The constructor takes as input id, name, allergies and bed number of a patient. By default, bad number is None.

Write a class Hospital that satisfies the following specifications:

The class constructor takes as input name of the hospital and its capacity to admit number of patients. It also initializes an empty list of patients.

The add method of takes as input an object of class Patient. The add method first checks whether number of patients admitted is less than the capacity. If yes, the patient is added to the list of patients and a message is printed that the patient with a particular name is admitted. In case the number of patients already admitted is equal to its capacity, a message is printed that the hospital is full.

The discharge method of takes as input the name of a patient. If the patient exists in the list of admitted patients, the patient is removed from the list along with confirmation. If the patient does not exist, then a message is printed that the patient is not admitted.

The test cases and possible output are given below.

```python
class Patient(object):
    def __init__(self, id, name, allergies, bed_number=None):
        self.id = id
        self.name = name
        self.allergies = allergies
        self.bed_number = bed_number




class Hospital(object):
    def __init__(self, name, capacity):
        self.name = name
        self.patients = []
        self.capacity = capacity
```

```python
    def add(self, patient):
        if len(self.patients) >= self.capacity:
            print ('Sorry! The Hospital is full!')
        else:
            patient_dictionary = {
            'ID': patient.id,
            'Name': patient.name,
            'Allergies': patient.allergies,
            'Bed Number': patient.bed_number
            }
            self.patients.append(patient_dictionary)
            print ('{} has been admitted.'.format(patient.name))

    def discharge(self, name):
        for value in self.patients:
            if value['Name'] == name:
                value['Bed Number'] = None
                self.patients.remove(value)
                print ("Patient ", name, " is discharged.")
```

```
>>>patient1 = Patient(1, 'Ash', 'Wool', 1)
>>>patient2 = Patient(1, 'Sterling', 'Chocolate', 3)
>>>patient3 = Patient(1, 'Alish', 'Puppies', 7)
>>>patient4 = Patient(1, 'Andre', 'Kitties', 9)
>>>hospital = Hospital('Hospital', 3)
>>>hospital.add(patient1)
Ash has been admitted.
>>>hospital.add(patient2)
Sterling has been admitted.
>>>hospital.add(patient3)
Alish has been admitted.
>>>hospital.add(patient4)
Sorry! The Hospital is full!
>>>hospital.discharge('Alish')
Patient  Alish  is discharged.
>>>hospital.discharge('Sterling')
Patient  Sterling  is discharged.
>>>hospital.add(patient4)
Andre has been admitted.
```

Q. 6. Functional programming in Java and Python

A. What is the output of following Python codes which uses Lambda expressions?

```python
my_list = [10, 5, 4, 12, 15, 25, 52, 32]
new_list = list(filter(lambda x: (x%5 != 0) , my_list))
print(new_list)
```
Output: _____ [4, 12, 52, 32]

```python
my_list = [10, 5, 4, 12, 15, 25, 52, 32]
expr2 = lambda data: ((data[len(data)-1] - data[0])/data[0] * 100.0)
print(expr2(my_list))
```
Output: _____ 220.000

B. Consider the following Java source code to answer questions in this section. What will be the value of players array after each sorting operation?

```java
import java.util.Arrays;
import java.util.Comparator;
public class LambdaSorting {
    public static void main(String[] args) {
        String[] players = {"Son Heungmin", "Park Jisung", "Shinsoo Choo", "Cha
        Bumkun",  "Lee Woonjae"};
        Arrays.sort(players, (String s1, String s2) -> (s1.compareTo(s2)));
        Arrays.asList(players).forEach((player) -> System.out.println(player));
```

Cha Bumkun, Lee Woonjae, Park Jisung
Shinsoo Choo, Son Heungmin

```java
        Arrays.sort(players, (String s1, String s2) -> (s1.substring(s1.indexOf("
        ")).compareTo(s2.substring(s2.indexOf(" ")))));
        Arrays.asList(players).forEach((player) -> System.out.println(player));
```

Cha Bumkun, Shinsoo Choo, Son Heungmin
Park Jisung, Lee Woonjae

```java
        Arrays.sort(players, (String s1, String s2) -> (s1.length() - s2.length()));
        Arrays.asList(players).forEach((player) -> System.out.println(player));
```
Cha Bumkun, Park Jisung, Lee Woonjae
Shinsoo Choo, Son Heungmin

```java
    }
}
```

Q. 7. SML programming

A. Define a function `sumlists: int list * int list -> int list` which takes in input two lists of integers and gives as result the list of the sums of the elements in corresponding position in the input lists. The shortest list has to be seen as extended with 0's. Examples:

```
sumlists([],[]) = []
sumlists([1,2],[3,4]) = [4,6]
sumlists([1],[3,4,2]) = [4,4,2]
sumlists([1,6],[3]) = [4,6]


fun sumlists(l,[]) = l

    | sumlists([],k) = k

    | sumlists(x::l,y::k) = (x+y)::sumlists(l,k);
```

B. Write a function compress to remove consecutive duplicates from a list.

```
compress ["a","a","a","b","c","c","a","a"];
val it = ["a","b","c","a"] : string list


    fun compress (lst) = if tl(lst) = [] then lst

            else if hd(lst) = hd(tl(lst)) then compress (tl(lst))

            else hd(lst)::compress(tl(lst))
```

C. Define a function copy: int * 'a -> 'a list such that copy(k,x) gives the list containing k occurrences of x. Examples:

```
copy(0,5) = []
copy(1,5) = [5]
copy(3,"a") = ["a","a","a"]
copy(3,copy(1,8)) = [[8],[8],[8]]

    fun copy(0,x) = []
      | copy(n,x) = x::copy(n-1,x);
```

Q. 8. SML programming, JavaScript

A. Following is a definition of SML filter function:
```
fun filter p [] = []
  | filter p (x::xs) = if p x then x :: filter p xs
                       else filter p xs
```
What will be the output of following function calls?

```
filter (fn(x) => x<6) [6,~3,0,1,~8,~5,9,3];
```
_____ `[~3,0,1,~8,~5,3]`

```
filter (fn(x) => x*x>36) [6,~3,0,1,~8,~5,9,3];
```
_____ `[~8,9]`

B. What will be the code output of following Javascript code fragments?

```
console.log(1 +  "2" + "2");
```
_____ "122"

```
console.log(1 +  +"2" + "2");
```
_____ "32"

```
console.log(1 +  -"1" + "2");
```
_____ "02"

```
console.log(+"1" +  "1" + "2");
```
_____ "112"

```
console.log( "A" - "B" + "2");
```
_____ "NaN2"

```
console.log( "A" - "B" + 2);
```
_____ "NaN"

C. What will be the code output of following Javascript code fragment?
```
console.log((function f(n){return ((n > 1) ? n * f(n-1) : n)})(5));
```

Output:

_____ 120

Q. 9. JavaScript

1. What is the HTML tag under which one can write the JavaScript code?

A) `<javascript>`

B) `<scripted>`

C) `<script>`

D) `<js>`

2. Choose the correct JavaScript syntax to change the content of the following HTML code.

`<p id="txt">Programming Abstractions</p>`

A) `document.getElement("txt").innerHTML="Cool course!!";`

B) `document.getElementById("txt").innerHTML=" Cool course!!";`

C) `document.getId("txt")=" Cool course!!";`

D) `document.getElementById("txt").innerHTML= Cool course!!;`

3. Which of the following is the correct syntax to display "Agile programming" in an alert box using JavaScript?

A) `alertbox("Agile programming");`

B) `msg("Agile programming");`

C) `msgbox("Agile programming");`

D) `alert("Agile programming");`

4. What is the correct syntax for referring to an external script called "data.js"?

A) `<script src="data.js">`

B) `<script href="data.js">`

C) `<script ref="data.js">`

D) `<script name="data.js">`

5. What is the output of the following JavaScript code?

```
<script type="text/javascript" language="javascript">
var x=5;
var y=6;
var res=eval("x*y");
document.write(res);
</script>
```

A) "30"

B) 30

C) 5*6

D) "5*6"

6. Which of the following is correct syntax to initialize an array in JavaScript?

```
A) var universities = "SUNYK", "GUGC", "GMU"

B) var universities = (1:SUNYK, 2:GUGC, 3:GMU)

C) var universities = (1=SUNYK, 2=GUGC, 3=GMU)

D) var universities = ["SUNYK", "GUGC", "GMU"]
```

7. What is the output of the following JavaScript code?

```
<script>
document.write(typeof(24.49));
</script>
```

```
A) float

B) number

C) integer

D) double
```

8. JavaScript is _____ language.

A) a compiled

B) an interpreted

9. Given that x = 5, what is the result of invoking following statements?

x == "5"	true/false
x === "5"	true/false

In addition to these questions:

All previous midterm exams and recitations problems also constitute the review.