

National University of Singapore  
School of Computing  
CS1010X: Programming Methodology  
Semester II, 2022/2023

**Recitation 4**  
**Data Abstraction**

## Python

1. *Tuple* - (*value1*, *value2*, ...)

A tuple is an immutable sequence of Python objects enclosed in parentheses and separated by commas.

2. Operations on tuples:

- (a) *len(x)* - Returns the number of elements of tuple *x*.
- (b) *element* in *x* - Returns True if *element* is in *x*, and False otherwise.
- (c) for *var* in *x* - Will iterate over all the elements of *x* with variable *var*.
- (d) *max(x)* - Returns the maximum element in the tuple *x*.
- (e) *min(x)* - Returns the minimum element in the tuple *x*.

## Problems

1. Evaluate the following expressions:

```
tup_a = (10, 12, 13, 14) #Creating tup_a
print(tup_a)

tup_b = ("CS1010X", "CS1231") #Creating tup_b
print(tup_b)

tup_c = tup_a + tup_b #Creating tup_c
print(tup_c)

len(tup_c)

14 in tup_a

11 in tup_c

tup_d = tup_b[0] * 4

tup_d[0]

tup_d[1:]
```

```
count = 0
for i in tup_a:
    count = count + i
print(count)

max(tup_a)

min(tup_a)

max(tup_c)

min(tup_c)
```

2. Write expressions whose values will print out like the following.

(1, 2, 3)

(1, (2), 3)

(1, (2,), 3)

((1, 2), (3, 4), (5, 6))

3. Write expressions to that will return the value 4 when the x is bound to the following values:

(7, 6, 5, 4, 3, 2, 1)

(7, (6, 5, 4), (3, 2), 1)

(7, ((6, 5, (4,)), 3), 2), 1)

4. You found a holiday assignment at the Registrar's Office. Your job is to write a program to help students with their scheduling of classes. You are provided with an implementation of the records for each class as follows:

```
def make_module(course_code, units):
    return (course_code, units)

def make_units(lecture, tutorial, lab, homework, prep):
    return (lecture, tutorial, lab, homework, prep)

def get_module_code(course):
    return course[0]

def get_module_units(course):
    return course[1]

def get_module_total_units(units):
    return units[0] + units[1] + units[2] + units[3] + units[4]
```

Each class (course) has a course code and an associated number of credit unit, e.g. for CS1101S, that's 3-2-1-3-3. Your job is now to write a schedule object to represent the sets of classes taken by a student. **Note:** Since class is a keyword in Python, we will use course as the variable representing the current class of interest.

- (a) Write a constructor `make_empty_schedule()` that returns an empty schedule.

```
def make_empty_schedule():
```

Order of growth in time, space?

- (b) Write a function `add_class` that when given a class and a schedule, returns a new schedule including the new class:

```
def add_class(course, schedule):
```

Order of growth in time, space?

- (c) Write a function `total_scheduled_units` that computes the total number of units in a specified schedule.

```
def total_scheduled_units(schedule):
```

Order of growth in time, space?

- (d) Write a function `drop_class` that returns a new schedule with a particular class dropped from a specified schedule.

```
def drop_class(schedule, course):
```

Order of growth in time, space?

- (e) Implement a credit limit by taking in a schedule, and returning a new schedule that has total number of units is less than or equal to `max_credits` by removing classes from the specified schedule.

```
def credit_limit(schedule, max_credits):
```

Order of growth in time, space?

- (f) **Homework:** Implement an improved version of `credit_limit` that will return a schedule with a total number of units is less than or equal to `max_credits`, but with the maximal number of classes. What is the order of growth of your solution? Is that the best you can do?