

# ICT Exercise I

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1. Show the sequence of numbers that would be generated by each of the following range expressions.

- (a) `range(5)`
- (b) `range(3, 10)`
- (c) `range(4, 13, 3)`
- (d) `range(15, 5, -2)`
- (e) `range(5, 3)`

2. Show the output that would be generated by each of the following program fragments.

- (a) 

```
for i in range(1, 11):  
    print (i*i)
```
- (b) 

```
for i in [1,3,5,7,9]:  
    print(i, ":", i**3)  
print(i)
```

3. What does the following code print?

```
1 T = (0.1, 0.1)  
2 x = 0.0  
3 for i in range(len(T)):  
4     for j in T:  
5         x += i + j  
6         print(x)  
7 print(i)
```

4. Given the initial statements `s1 = [2,1,4,3]`, `s2 = ['c', 'a', 'b']` show the result of evaluating each of the following sequence expressions:

- (a) `s1 + s2`
- (b) `3 * s1 + 2 * s2`
- (c) `s1[1]`
- (d) `s1[1:3]`
- (e) `s1 + s2[-1]`

5. Given the same initial statements as in the previous problem, show the values of `s1` and `s2` after executing each of the following statements. Treat each part independently (i.e., assume that `s1` and `s2` start with their original values each time).
- (a) `s1.remove(2)`
  - (b) `s1.sort()`
  - (c) `s1.append([s2.index('b')])`
  - (d) `s2.pop(s1.pop(2))`
  - (e) `s2.insert(s1[0], 'd')`
6. Write a program that asks for user input and performs
- Celsius to Fahrenheit conversion.
  - Fahrenheit to Celsius conversion.
  - Meter to foot conversion.
  - Foot to meter conversion.
  - Acre to square meter conversion.
  - Square meter to acre conversion.
  - Pound to kilogram conversion.
  - Kilogram to pound conversion.
7. Write a function that takes a list as the only argument and returns the following:
- the number of odd items in the list;
  - the average of all the items in the list;
  - the sum of squared items in the list.
8. Write a function that computes and simplifies the following expression.

$$\prod_{i=1}^5 \sum_{j=i}^5 j(\sin(x) + \cos(x))$$

9. The Maclaurin series up to order  $N$  for  $e^x$  is defined as follows:

$$e^x \approx \sum_{n=0}^N \frac{x^n}{n!}$$

Write a function that accepts an integer  $N$ . Define an expression for this equation, then substitute in  $-y^2$  for  $x$  to get a truncated Maclaurin series of  $e^{-y^2}$ . **Lambdify** the resulting expression and plot the series on the domain  $y \in [-2, 2]$ . Plot  $e^{-y^2}$  over the same domain for comparison. Call your function with increasing values of  $N$  to check that the series converges correctly.

10. Write a Python script that computes tidal elevation  $h$  (in m) from the following three term series:

$$h(t) = 0.2 \sin(0.5\omega t) + 3.0 \sin(\omega t) + 1.0 \sin(2\omega t)$$

where  $\omega = 2\pi/24 \text{ hr}^{-1}$ . Define a vector time with 1001 values  $[0., 0.1, 0.2, \dots, 100.0.]$  spaced every 0.1 hours from  $t = 0$  to  $t = 100$  hrs. **Plot** the tidal elevations **vs.** time. **Label** both axes and include a plot title.