

Aims

The aims of this computing tutorial are to understand the concept of arrays in programming, and to have some experience with using arrays in Python.

Questions

[Ref: Python Notes Section A.6.1-A.6.4] Read Section 6 of the Python Notes carefully. Ask your tutor if you are confused about anything in this Section.

1. Consider the following array created in Python: `A = array([1, 2, 3, 4, 5])`

What would each of the following commands produce? Work it out for yourself and then use Python to verify your answers:

- (a) `print A[1]`
- (b) `print A[0]`
- (c) `print A[A[0]]`
- (d) `print A[A[1]+A[2]]`
- (e) `print A[A[A[A[A[0]]]]]`

2. Write down all of the output generated by each of the following Python programs, evaluating it by hand.

```
from __future__ import division
from pylab import *
```

```
cs = zeros(7)
f = 0
while f < size(cs) :
    if f > 2 :
        cs[f] = 7-4*f
    f = f+1
print "cs =", cs
```

```
from __future__ import division
from pylab import *
```

```
ps = zeros(10)
j = 0
while j < size(ps) :
    if j % 3 == 0 :
        ps[j] = 2*3*j
    j = j+1
print "ps =", ps
```

3. Over the last three weeks we have developed a Python program that estimates the human body surface area (BSA) given the weight and height of a person, estimates the value of the Widmark factor r for males and females, and also estimates the time for BAC to return to 0 after consuming a range of quantities of alcohol. This week we will extend what this program does. First, take a copy of your program from last week and give it a new name. We will work on this new copy of the program.

- (a) Modify your program so that (in addition to what it did before):

- The following, modified menu is printed at the start:

```
Please select from this list of options:
Enter 1 to calculate body surface area.
Enter 2 to estimate the time for BAC to return to 0.
Enter 3 to calculate BACs during the absorption phase.
Your choice?
```

- If the user chooses Option 3, then:

- * the user is asked to enter the number of standard drinks consumed (we will assume that these drinks are consumed very rapidly)
- * the user is asked to enter the gender, weight and height of the drinker
- * the program calculates, at 5 minute intervals from time 0 hours to time 1 hour, the estimated BAC if the alcohol is consumed on an empty stomach and on a full stomach
- * these values must be stored in arrays called `BACempty` and `BACfull` respectively.
- * when all calculations are complete, the program must print a table of data, showing each time at which an estimate was made, followed by the two estimates of BAC at that time, followed by the difference in estimated BACs at that time.

(b) Run your program for a female of height 155 cm and weight 38.5 kg, rapidly consuming 2 standard drinks. Compare the program output at time 10 minutes with the value you calculated on the tutorial sheet this week. (As usual, if the answers do not agree then you have made an error somewhere.)

4. Modify your program so that if Option 3 is selected, the program also prints the time at which the difference between the estimated BACs (empty stomach versus full stomach) has its largest value. Also print the value of the largest difference.
5. **Assessment Question (1.5%): BSA/BAC to 0/Absorption program.** Make sure that your program from the previous question is commented, has sensible variable names, and includes useful output messages. Test your program on the following cases, where appropriate comparing the output values with hand calculations you have done previously.

Case	Drinks	Weight (kg)	Height (cm)	gender
BSA	–	38.5	155	female
Time for BAC to 0	5	107	188	male
BAC during absorption	2	38.5	155	female

This program will contribute 1.5% towards your final assessment for SCIE1000. **To receive these marks, you must demonstrate your program and its output to a tutor during your tutorial.** Program output, including text messages and correct values, are together worth up to 1.0%. Appropriate comments and variable names are together worth 0.5%.

6. In the Lecture notes we saw how a quadratic function can be used to calculate the proportion of thrush-positive cells in a habitat; the function was

$$p(t) = -0.0747t^2 + 1.8693t - 10.918$$

- (a) Write a Python program that calculates the probability of a cell being thrush-positive for all temperature values when t is an integer between 10 and 15. Use an array to store the calculated probability values. Once all values have been calculated, the program should print out the results:

```
When t = 10 degrees C, the probability of finding a thrush is 0.305
When t = 11 degrees C, the probability of finding a thrush is 0.6056
etc.
```

(Hint: use a while loop to do this)

- (b) Modify your program from (a) so that it also calculates and prints out the difference between successive probability values, e.g:

```
Moving from t = 10 to t = 11, the probability of observing a thrush
increases by <some value>%
Moving from t = 11 to t = 12, the...
...
Moving from t = 14 to t = 15, the probability of observing a thrush
decreases by <some value>%
```

(Hints: you might store your difference values in a second array. Use an if statement to determine whether to print out "increase" or "decrease" as appropriate)