

KIT103/KMA155 Programming Assignment 1: Sets

Enter your answers to these questions in the accompanying Python script file `programming1.py`. Each question has an entry in a dictionary of answers that is initially set to `None`. Replace this with the requested Python expression (that is, code that generates a value). For instance, to answer Question 1 part a you could put:

```
ans['Q1 a'] = { 'this', 'is', 'just', 'an', 'example' }
```

Wherever a question indicates that certain values are given and must be used in your answer you will find that these variables are also defined in the script file.

Submit your completed script file to the *Programming Assignment 1: Sets* assignment folder on MyLO by **1500 (3pm) Wednesday 14 August 2019**.

Each question part is worth 0.25 marks.

Question 1: Literal Values

Write these sets as literal values (i.e., program text that *literally* represents the value described).

- the first 5 positive even numbers greater than zero
- the names *Ada*, *Alan*, *Claude* and *George* (with that capitalisation)
- the set of English vowels (a, e, i, o and u; remember to put them inside quote marks)

Question 2: Set Comprehensions

Write set comprehensions to generate the following sets:

- the set { 6, 12, 18, 24, 30, 36, 42 }
- cubes of the first 6 positive integers (i.e., { 1^3 , 2^3 , 3^3 , 4^3 , 5^3 , 6^3 })
(tip: Python has an exponentiation operator `**`)
- the set of letters in the word 'woolloomooloo' (hint: strings in Python can be treated exactly like lists of characters). Your solution should still work if we were to change the word, so *do not* remove repeated letters yourself.

Question 3: Relationships

Assume that the following sets have been defined:

```
animals = {'cow', 'gorilla', 'hermit crab', 'human', 'iguana', 'mola mola',
           'parrot', 'spider', 'tunicate'}
tetrapods = {'cow', 'gorilla', 'human', 'iguana', 'mola mola', 'parrot'}
chordates = {'cow', 'gorilla', 'human', 'iguana', 'mola mola', 'parrot',
            'tunicate'}
mammals = {'cow', 'gorilla', 'human'}
pets = {'cow', 'hermit crab', 'iguana', 'parrot', 'rock', 'spider'}
can_swim = {'cow', 'human', 'iguana', 'mola mola'}
```

Write boolean expressions using Python set comparison operators (i.e., `issubset()`, `<=`, `==`, etc.) and the above sets to answer the questions below. Do not simply say yes or no (imagine that the sets

above were actually complete and so too large for you to answer these questions unaided). Ensure you answer the question as asked.

- Are pets a proper subset of animals?
- Can all pets swim?
- Are all mammals also tetrapods (four-limbed animals)?

Question 4: Set membership

Given the sets defined in Question 3, identify the following subgroups (as in, sets). As above, write the Python code that will find the answer.

- Chordates that are not tetrapods.
- Things that can swim or be pets.
- Pets that can swim but are not mammals.

Question 5: Combinations

You have been tasked with enumerating the possible outcomes of the board game [Cluedo](#), in which players must deduce the identity of a murderer, what weapon they used, and where they committed the act. Given the following (sub)sets of suspects, weapons and rooms from the game, write set comprehensions that will generate the possible combinations described below.

```
suspects = { 'Miss Scarlett', 'Colonel Mustard', 'Professor Plum' }
weapons = { 'candlestick', 'lead pipe', 'revolver' }
rooms = { 'kitchen', 'conservatory', 'library', 'dining room' }
```

- Generate all pairs of suspects and rooms.
- Generate novel kinds of weapon by combining them as pairs. These can (indeed, will) include the same basic weapon repeated.
- Generate all triples (3-tuples) of suspects, weapons and rooms.

Question 6: Bags & Bitsets

- Write a dictionary literal that compactly represents the bag/multiset { 'house', 'car', 'house', 'key', 'car', 'car' }

Parts b through e assume the following are defined: a universe of discourse $\mathcal{U} = \{ \text{'alfa', 'bravo', 'charlie', 'delta', 'echo'} \}$, and sets `set1 = { 'bravo', 'charlie' }` and `set2 = { 'bravo', 'delta', 'echo' }`.

- Write the binary literal value that encodes `set1` as a 5-bit long bitset. (Remember that a binary literal begins with `0b`.)
- Write the binary literal value that encodes `set2` as a 5-bit long bitset.
- Write the binary literal that corresponds to the result of the set operation `set1 \oplus set2`.
- Referring to the bitset representations of `set1` and `set2` stored in your previous answers `ans['Q6 b']` and `ans['Q6 c']`, respectively, write the bitwise expression that would calculate the result of the set operation `set1 \cap set2`. (Remember to write the Python code to calculate the answer, not the answer itself.)

How your assignment is assessed

Your submitted Python script will be assessed initially by a Python program that will execute your code and check the values generated by your answers against the expected results. This produces a tab-delimited text file named `AssessmentReport.txt` with columns containing the *expected* result, the *actual* result produced by your code, the *score* achieved for that question (and *maximum score* possible), and any *feedback* explaining the score.

Next, a human assessor will inspect your submission and adjust the computer-based assessment accordingly: code that produced the wrong value but is close to correct will have some marks restored; code that produced the correct answer but did so incorrectly may have marks reduced. The assessor will add further feedback to the assessment report text file as needed.

You can download the Assessment Report from MyLO: go to Assignments then click feedback link in the Evaluation Status column. View it in Excel, Numbers or another spreadsheet program.

Assessment criteria

Full marks will be awarded to answers (Python expressions) that:

- generate the correct value;
- use an appropriate approach to producing that value; and
- are written using the technique specified in the question

Partial marks are awarded for answers that meet only some of these criteria. Answers that do not use the technique specified by the question may receive 0 as they do not demonstrate the required skill.

Working independently: This is an individual assignment so [your submission should be substantially your own work](#).