



A1.1 Data types and programming constructs

Programming techniques and object-oriented programming · A level ·
OCR H446 2.2.1, AQA 7517 4.1.1.1, Eduqas A500QS 1.4 · about 20 min

What this lesson is about

The A level data types, references and user-defined types, constants, and definite and indefinite iteration.

- The types you need to know
- References: two names, one value
- User-defined types
- Declaration, assignment and constants
- Iteration: definite and indefinite

Questions

6 marks in all

1. A variable holds the location in memory where a list of readings is stored, rather than the readings themselves. What is its data type? [1 mark]

- ☐ A Pointer/reference
☐ B Array
☐ C Record
☐ D Integer

Answer: A. A pointer or reference holds where a value is stored, not the value.

2. What does this program print? [1 mark]

```
a = [1, 2]
b = a
b.append(3)
c = list(a)
c.append(4)
print(a, len(c))
```

Answer:

[1, 2, 3] 4

b refers to the same list as a, so a becomes [1, 2, 3]; c is a new copy, so appending to it leaves a alone.

3. A loop has its condition tested at the end. What is always true of it? [1 mark]

- ☐ A Its body runs at least once
☐ B Its body may run zero times
☐ C It is definite iteration
☐ D It cannot use a Boolean condition

Answer: A. The body runs before the condition is first checked, so it runs at least once.

4. Which are advantages of using a named constant such as `SAFE_CM` instead of typing 25 wherever it is needed? [1 mark]

Tick every answer that is true.

- ☐ A The value only has to be changed in one place
- ☐ B The name explains what the value means
- ☐ C It cannot be changed by mistake while the program runs, in a language that enforces constants
- ☐ D It makes the program run in less memory

Answer: A, B, C. Constants help maintenance, readability and safety; they do not reliably save memory.

5. A robot must repeat 'drive 5 cm' until the wall is 25 cm away. The number of repeats is not known in advance. What kind of iteration is this? [1 mark]

- ☐ A Indefinite iteration
- ☐ B Definite iteration
- ☐ C Recursion
- ☐ D Selection

Answer: A. The loop stops when a condition changes, not after a known count.

6. Python has no character type. What type does it use to store a single character such as "F"? Give the Python type name. [1 mark]

Answer: str. A character is a str of length 1.

The task: readings as a record type

Define a record type `Reading` with `namedtuple` and three fields: `heading` (an integer, 0, 90, 180 or 270), `cm` (the real number `distance()` returns) and `clear` (a Boolean, `True` when `cm` is more than the constant `CLEAR_CM`). Declare `CLEAR_CM = 40` as a constant and use the name, not `40`, in the comparison. The robot starts facing heading 0. Take a reading, store it in an array, turn right 90 degrees, and repeat until there are four readings and the robot faces its starting direction. Then print each record with `print(r)`, which shows `Reading(heading=90, cm=51.0, clear=True)`, and finally print `clear directions: <n>`, the number of records whose `clear` field is `True`.

```
# the two lines every program starts with: the commands, then the robot
from bugbot import *
connect()

from collections import namedtuple

Reading = namedtuple("Reading", ["heading", "cm", "clear"])

survey = []
# take four readings, one every 90 degrees

print("clear directions:", 0)
```

The hint students can ask for: Decide the three fields first and what type each one holds. Then one definite loop does the looking: read, build a record, add it to the array, turn a quarter. A second loop over the array does the counting.

A solution

```
# the two lines every program starts with: the commands, then the robot
from bugbot import *
connect()

from collections import namedtuple

CLEAR_CM = 40
Reading = namedtuple("Reading", ["heading", "cm", "clear"])

survey = []
for i in range(4):
    cm = distance()
    survey.append(Reading(i * 90, cm, cm > CLEAR_CM))
    turn_right(30, angle=90)

clear = 0
for r in survey:
    print(r)
    if r.clear:
        clear = clear + 1
print("clear directions:", clear)
```

Any program that meets the task's checks is marked correct in the simulator; this is one way, not the only way.