Grade 10 Computing

Unit 1 · Bigger Programs

ANSWER KEY · FOR TEACHERS

Full marks 32

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. pure function
2. side effect
3. scope
4. module
5. library
6. namespace
7. API
8. JSON

Each carries 0.5 mark. **K · 4**

2 Label the diagram

1. the computer to ask
2. how far east
3. what you want: a forecast
4. query parameters: name=value pairs, joined by &

Each carries 0.5 mark. **U · 2**

3 Multiple choice

i. **b.** a function that takes a price and a number of plates of momo and returns the total **U · 1**

It takes values in and gives a value back, and does nothing else, so the same inputs always give the same answer. Printing, changing a list outside the function, and writing a file are all side effects.

ii. **b.** the main steps of the program, as calls to functions not yet written **K · 1**

Top-down design starts from the whole job: the main steps, written as if each function already existed. Then each function is written, and split further if it is still too big. (Writing small parts first and combining them is called bottom-up; both are used, but the question asks about top-down.)

iii. **a.** It uses the global rate, 13. **U · 1**

The function only reads **rate**; it never assigns to it, so **rate** is not local. Python looks in the global box next and finds 13. Reading a global constant like this is fine. Only assigning to a name makes it local.

iv. **b.** round_to(3.14159, places=2) **A · 1**

The `*` means **places** must be given by name, so `round_to(3.14159, 2)` raises a TypeError. **x** has no default, so it must be given; the `*` itself is never typed.

v. **c.** `data["tea_gardens"][0]["area"]` **A · 1**

`data["tea_gardens"]` is a list; `[0]` is its first item, a dictionary; `["area"]` is that dictionary's value for the key area. A list is reached by position, a dictionary by key. (The garden and its number are made up for the question.)

4 What does it print?

a. **MARKING SCHEME** **U · 3**

- ✓ `30`: line 4 makes a local **total** of 50 inside **spend**, and 50 − 20 = 30.
- ✓ `101`: **show** never assigns to **total**, so it reads the global one, 100.
- ✓ `100`: the global **total** was never changed; the 50 lived only in spend's own box.

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b. MARKING SCHEME A · 3

- ✓ `[72, 63]`, the two highest marks.
- ✓ `[72, 63, 45, 21]`: **marks** is another name for the same list as **science**, so `sort()` on line 2 changed the class's own list.
- ✓ `21 2`: `sorted()` makes a new list, smallest first, and **best** has two items.

5 Trace the program

ANSWER A · 4

p	g	counts[g] after the round
(before)		
72	B+	1
53	C+	1
92	A+	1
75	B+	2
33	NG	1

```
OUTPUT
{'B+': 2, 'C+': 1, 'A+': 1, 'NG': 1}
```

MARKING SCHEME

- ✓ The grades B+, C+, A+, B+, NG: `grade_for` returns the first grade whose lowest percentage `p` reaches, and NG when none does.
- ✓ A grade seen for the first time is added with 1 (B+, C+, A+, NG).
- ✓ B+'s count becomes 2 in the fourth round, when 75 is met.
- ✓ The output `{'B+': 2, 'C+': 1, 'A+': 1, 'NG': 1}`, once, after the loop.

6 Find and fix the bug

ANSWER A · 3

i. Line 4, `count = count + people`, with an **UnboundLocalError**.

ii. **add_visitors** assigns to **count**, so Python makes **count** local everywhere in the function; line 4 then reads that local **count** before anything has been put in it.

iii.

```
def add_visitors(count, people):
    """The new count after people more visitors."""
    return count + people

count = 0
count = add_visitors(count, 12)
count = add_visitors(count, 30)
print(count)
```

```
OUTPUT
42
```

MARKING SCHEME

- ✓ Line 4, UnboundLocalError (line 6 is only where the call was made).
- ✓ Assigning to **count** inside the function makes it local, so the right-hand side reads a local with no value yet.
- ✓ The count passed in as a parameter and the new count returned, each call's answer stored back in **count** (`global count` works, but is not a pure function, so it gets no mark here).

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7 Write a program

ANSWER A · 4

```
import json

text = ('{"province": "Karnali", "lakes": [{"name": "Rara", "area_km2": 10.8}, '
        '{"name": "Phoksundo", "area_km2": 4.9}]}')

data = json.loads(text)
largest = None
for lake in data["lakes"]:
    print(lake["name"], lake["area_km2"], "km²")
    if largest is None or lake["area_km2"] > largest["area_km2"]:
        largest = lake
print("Largest:", largest["name"])
```

```
OUTPUT
Rara 10.8 km²
Phoksundo 4.9 km²
Largest: Rara
```

Another right way for the last part: `max(data["lakes"], key=lambda lake: lake["area_km2"])["name"]`.

MARKING SCHEME

- ✓ `import json` and `json.loads(text)`, giving a dictionary.
- ✓ A loop over `data["lakes"]`, a list of dictionaries.
- ✓ Each lake's name and area printed, reached by their keys (`lake["name"]`, `lake["area_km2"]`).
- ✓ The largest found by comparing the areas (a highest-so-far loop, or `max`), and its name printed.

8 Short answer

MARKING SCHEME U · 2

- ✓ Run by itself, `__name__` is `"__main__"`, so the test runs and prints the bill for 2 plates at Rs 150, 300.
- ✓ Imported, `__name__` is `"shop"`, so nothing is printed: the program gets the function without the test.

9 Think

ANSWER HA · 2

The other files use marks_file.py only through its interface: the function `read_marks(file_name)`, which still has the same name and parameter and still gives back the same kind of list of dictionaries. How it reads the file is hidden inside it (**information hiding**). In a big program written by many people, a module's insides can then be fixed, sped up or rewritten by one person without anyone else changing their code, and a change in one place can't break the rest, as long as the interface stays the same.

MARKING SCHEME

- ✓ Its interface didn't change (the same function name and parameter, the same list of dictionaries given back); only its insides did, and the other files use only the interface.
- ✓ Information hiding: in a big program, one module can be changed, fixed or improved without anyone changing the code that uses it, so changes stay in one place.

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10 Activity: Ask the districts API

(not marked)

WHAT STUDENTS SHOULD FIND

- `/provinces`: **200 OK**, the 7 provinces, each with its number of districts; Karnali has 10.
- `/districts?province=Karnali`: **200 OK**, 10 districts in alphabetical order, the first Dailekh.
- `/districts/Bhaktapur`: **200 OK**, province Bagmati, headquarters Bhaktapur, population 432,132 (2021).
- `/districts/Baktapur`: **404 Not Found**: nothing is at that address.
- `/districts?province=Karnaly`: **400 Bad Request**, with a message that no such province exists and the list of the right names.
- Capital letters don't matter to this API; spelling does.

Marks by level	Knowledge	Understanding	Application	Higher ability	**Total**
Marks	5	9	16	2	**32**

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