Unit 5 · Computers in the World

WORKSHEET

Full marks 32

Name _____ Class _____ Roll no. ____ Date _____ Marks _____ / 32

1 Key words [4]

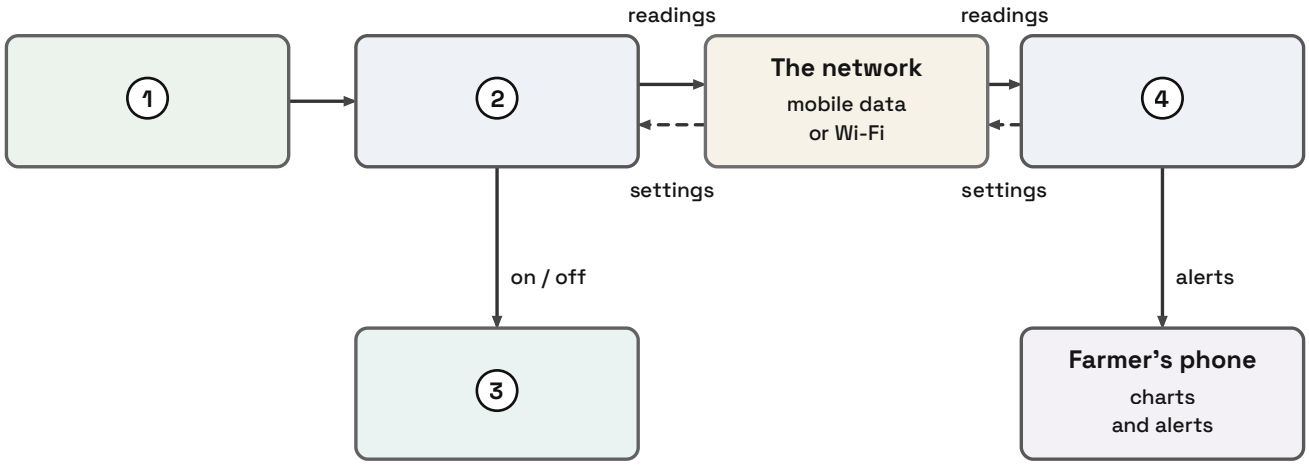
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

accuracy	**actuator**	**failover**	**Internet of Things**	**latency**	**redundancy**	**resolution**
sensor	**single point of failure**	**trilateration**				

A _____ measures something in the world, and an _____, such as a motor or a pump, acts on it. The smallest change a sensor can show is its _____. Everyday things with sensors, connected so they can send data and be controlled from far away, make up the _____. The time a message takes to arrive is its _____. A part whose failure stops the whole system is a _____, and the cure is _____: more than one of everything that matters. Finding a position from distances to satellites is called _____.

2 Label the diagram [2]

The diagram shows an Internet of Things system in a greenhouse. Write the name of each part in place of 1 to 4. Each carries 0.5 mark.



1. _____ 2. _____

3. _____ 4. _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. Which of these is an **actuator**? [1]

a. a soil-moisture sensor
b. a phone's camera
c. the motor that opens a gate
d. a temperature sensor

ii. A greenhouse's pump is switched on by a program on a server in another city. What is the biggest risk of that design? **[1]**

a. The server is too slow to decide.

b. If the network or the server fails, the pump can't be switched on or off.

c. The sensors can't measure moisture without the server.

d. The pump will use more water.

iii. A website runs on three servers in one building, behind a load balancer. Which event would still take it down? **[1]**

a. one server's disk fails

b. two servers crash at once

c. the building loses power for longer than its generator can run

d. one server is switched off for an update

iv. Why does a phone need signals from four satellites, not three, to find its place? **[1]**

a. Each satellite gives only part of its own position.

b. The phone's clock isn't accurate enough, so the clock's error is a fourth unknown, besides the three for the position.

c. One satellite is always a spare.

d. The phone sends a signal to the fourth to check.

v. Before selling her old phone, Pema backs up her photos and resets it to factory settings. What has she forgotten that could stop the buyer from using it? **[1]**

a. charging it to 100%

b. signing out of her Google account (or Apple ID) before the reset

c. deleting each photo one by one

d. removing the apps one by one

4 Work it out **[7]**

Show your working. Each part carries 1 mark.

a. i. A soil thermometer's ADC gives whole numbers from 0 to 1023 for temperatures from 0 °C to 50 °C. What is its resolution? **[4]**

ii. A GPS signal reaches a phone 0.0675 s after it left the satellite. How far away is the satellite? (Speed of light: 300,000 km/s.)

iii. A server is 2,900 km away in a straight line. At the very least, how long does a message take to go there and come back, in milliseconds? (Light in fiber: 200,000 km/s.)

iv. A service promises 99.95% availability. How many hours a year may it be down?

b. A data center's computers use 12 MW, and the whole building uses 18 MW, day and night. **[3]**

i. What is its PUE?

ii. How much electricity does it use in a year, in GWh?

iii. Upper Tamakoshi is designed to produce about 2,281 GWh a year. What share of that would this data center use?

5 What does it print? [6]

Write exactly what each program prints, in the box under it.

a. A map picture is 1,000 × 500 pixels, and the program places a latitude and longitude on it. **[3]**

```
1  width, height = 1000, 500
2  north, south = 27.70, 27.65
3  west, east = 85.40, 85.50
4
5  def to_pixel(lat, lon):
6      x = (lon - west) / (east - west) * width
7      y = (north - lat) / (north - south) * height
8      return round(x), round(y)
9
10 print(to_pixel(27.675, 85.45))
11 print(to_pixel(27.69, 85.42))
12 print(to_pixel(27.66, 85.52))
```

```
OUTPUT
```

What does the last answer tell the app?

b. A greenhouse sensor's log for the middle of a day, as a pandas DataFrame. **[3]**

```
import pandas as pd

log = pd.DataFrame({"hour": [9, 10, 11, 13, 14, 15],
                    "temperature": [23.1, 27.6, -127.0, 36.1, 35.2, 34.8]})
print(len(log), "readings")
missing = sorted(set(range(9, 16)) - set(log["hour"]))
print("Missing:", missing)
bad = log[(log["temperature"] < -20) | (log["temperature"] > 60)]
log = log.drop(bad.index)
print("Dropped:", list(bad["hour"]), "left:", len(log))
print("Hottest:", log["temperature"].max())
print("Mean:", round(log["temperature"].mean(), 1))
```

```
OUTPUT
```

6 Write a program **[4]**

Write the program in Python on the lines. Any program that gives the right result gets the marks.

A temperature sensor's readings come as a list, one an hour. `None` means the reading never arrived, and a sensor with a loose wire gives exactly `-127.0`. Write a function `summary(readings)` that gives back three things: how many readings are good (between −20 and 60 °C), the average of the good ones, rounded to one decimal place, and how many good readings are above 30 °C. For `[18.5, 23.1, None, -127.0, 31.0, 34.4, None, 33.0]` it should give `(5, 28.0, 3)`.

7 Short answer [2]

Write a short answer to the following question.

A wallet company copies every change to its database, within seconds, to two other servers in other cities. A worker deletes a table of payments by mistake. Will the copies save the data? What else does the company need?

8 Think [2]

Think, then answer.

Almost all of Nepal's electricity comes from hydropower, more than it needs in the monsoon and too little in the dry winter. Some people say Nepal should use its clean power to run data centers. Give one argument for and one against, and say who in Nepal might pay if it went wrong.

9 Activity: Copies of a service (not marked)

At a computer, open the unit's page (the QR code) and find **Copies of a service.** For each setting, run three years and write the days the service was down in each.

Copies	Where	Days the service was down (three years)
1	one building	
2	one building	
3	one building	
2	different cities	
3	different cities	
Why can't more copies in one building do better?		