LCCS
NW5 Session 2

Databases

Oide

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By the end of this session participants will have ...

- developed an understanding of Flat-file systems and databases

- explored the meaning of relational databases

- used the micro:bit datalogging feature to record and store temperature data from a micro:bit (generate a csv file)

- used a web application to populate and access a ThingSpeak database

- enhanced their web development skills through creating a dynamic website displaying real-time data

- acquired additional skills, knowledge and ideas in order to facilitate ALT1 in their own classrooms

Keywords

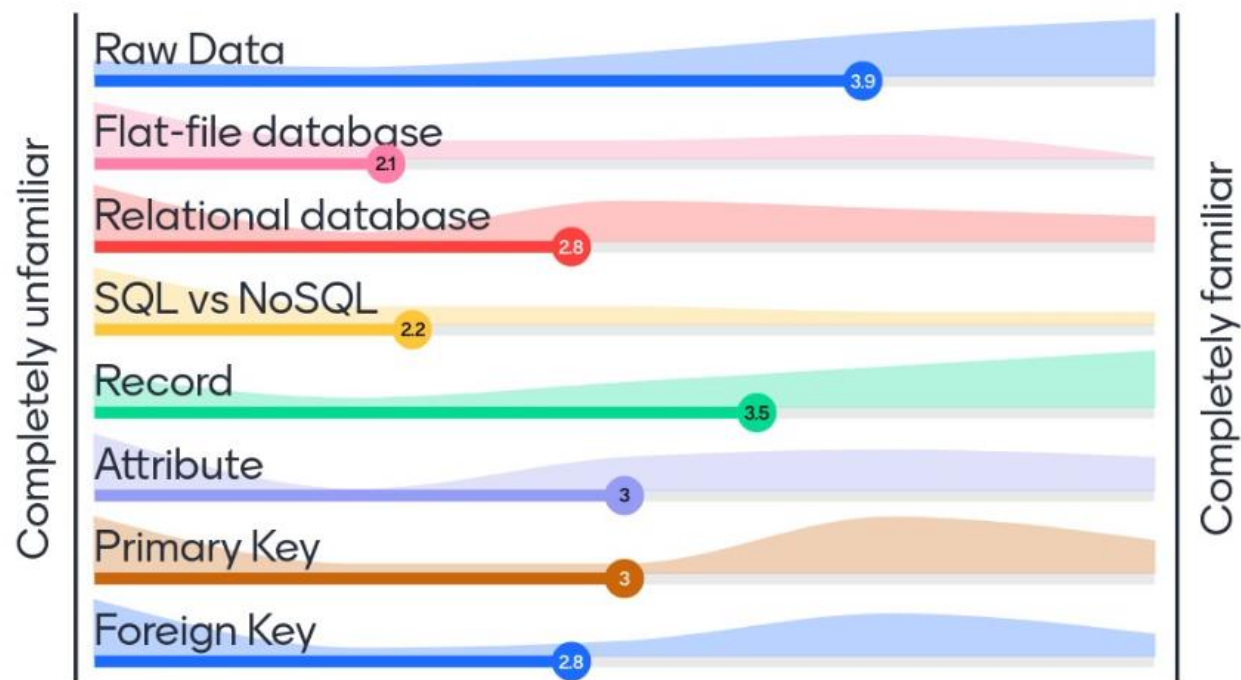|	I don't know the term at all	I've seen or heard the term but I don't know the meaning	I think I know the meaning	I know a meaning
Data (raw data)				
Database				
DBMS				
Non-relational database				
Relational database				
SQL				
NoSQL				
Record				
Field				
Primary Key				
Foreign Key				
System Architecture				
Client-server Model				
Front-end system				
Back-end system				

*Adapted from "An Integrated Approach to Learning, Teaching and Assessment", p28
https://pdst.ie/sites/default/files/Integrated%20Approach.pdf

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Please rate your own knowledge/undestanding with respect to the following terms/topics

Completely unfamiliar — Completely familiar

Term/Topic	Rating
Raw Data	3.9
Flat-file database	2.1
Relational database	2.8
SQL vs NoSQL	2.2
Record	3.5
Attribute	3
Primary Key	3
Foreign Key	2.8

Database Concepts

Database: A structured collection of related data

Columns (Attributes)

Rows
(Records)

owner_id	owner_name	address	dog_name	breed	dob	microchip
1	Joe Murphy	1 main st.	rover	labrador	22/11/2011	Y
1	Joe Murphy	1 main st.	fido	poodle	02/02/2020	Y
2	Ada Traore	9 park ave.	fido	jack russell	15/06/2015	N
1	Joe Murphy	1 main st.	champ	greyhound	01/01/2010	Y
2	Ada Traore	9 park ave.	spots	dalmation	24/08/2007	N
3	James Tidy	7 bond st.	buddy	rottweiler	21/10/2012	Y

- Data is stored in tables - organised by rows (tuples) and columns (attributes)
- Each row is called a record
- Each attribute value is called a field

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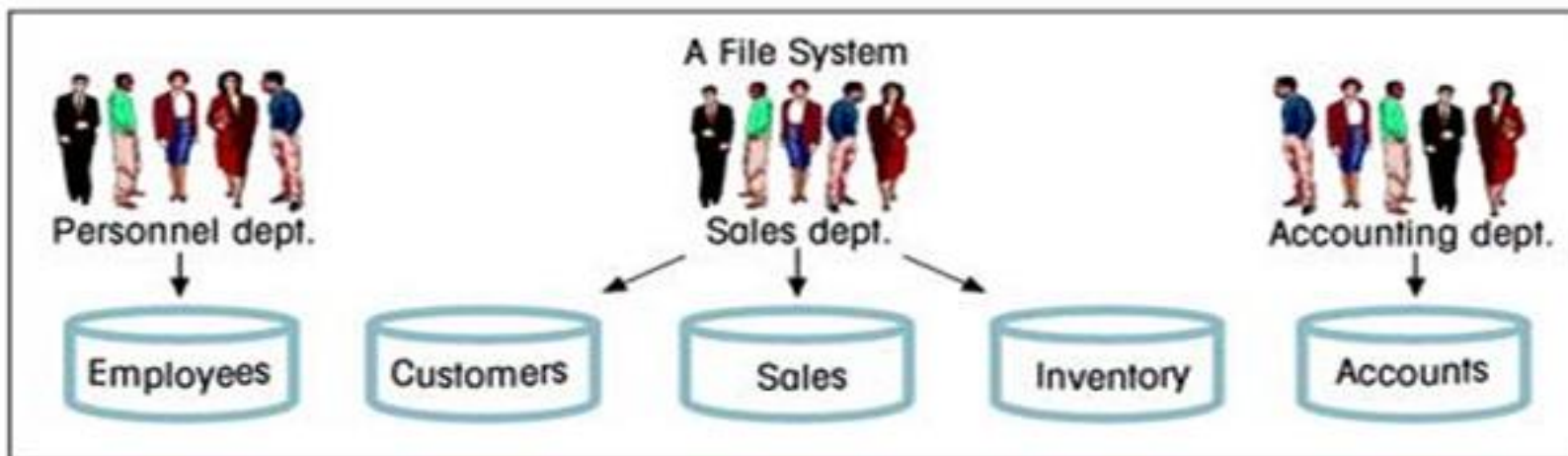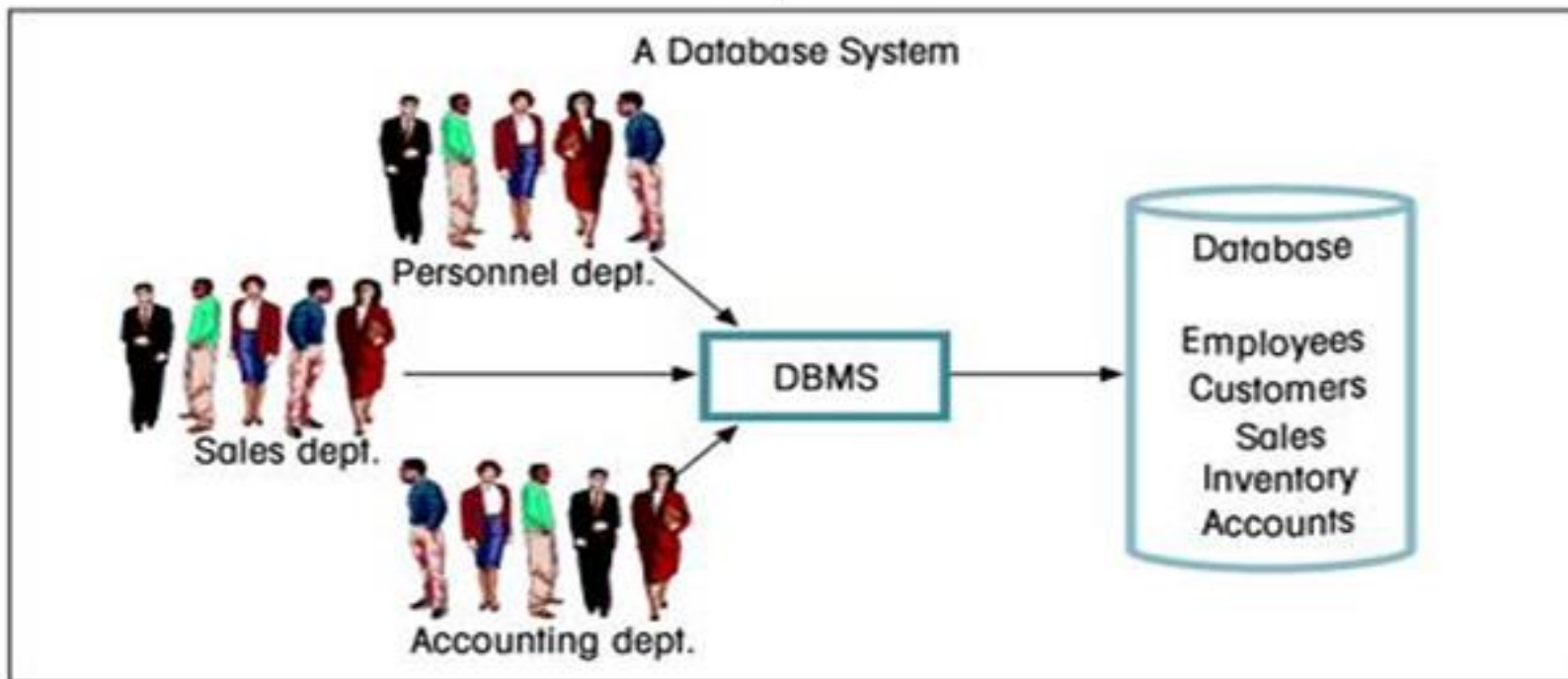
Database Concepts

Table: A set of data elements (values) organised by rows (records) and columns (attributes)

Attribute: A characteristic of the data in the table, describing a field or cell in a table.

Primary Key: A unique identifier for a row in a table

Would **dog_name** be a good PK?

What about **breed**?

dog_id	dog_name	breed	dob	microchip
1	rover	labrador	22/11/2011	Y
2	fido	poodle	02/02/2020	Y
3	fido	jack russell	15/06/2015	N
4	champ	greyhound	01/01/2010	Y
5	spots	dalmation	24/08/2007	N
6	buddy	rottweiler	21/10/2012	Y

Creating a Flat-file database - Activity

P14 – 16

Database Activity
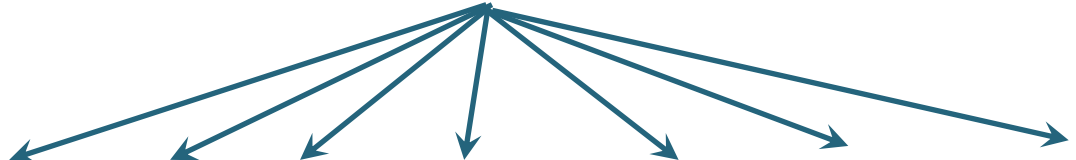
Columns (Attributes)

Primary key
people_ID is a unique identifier for each record.

Rows (Records)

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people_ID	Name	Age	Address	Occupation	Commute Method	Distance to Work	Workplace
1	Paul Johnson	29	47 Main Street	Teacher at Irisheen National School	Walk	0.5 km	Irisheen National School
2	Michael Brown	42	23 Oak Avenue	Accountant	Bus	16 km	Town Office
3	Sarah Williams	35	12 Main Street	Nurse at Irisheen Community Hospital	Cycle	3 km	Irisheen Community Hospital
4	David Lee	28	50 Elm Drive	Software Developer	Works from Home	0 km	N/A
5	Mia Connor	41	Lake View House	Principal	Car	10km	Irisheen National School
6	Patricia Murphy	31	4 Oak Lane	Graphic Designer	Car	12 km	Glenvalley
7	Liam O'Connor	35	22 River Road	Gardener	Walk	1 km	Irisheen Park
8	Aoife Ryan	29	21 Green Street	Pharmacist	Car	8 km	Watertown Pharmacy
9	Michael Brown	36	5 Main Street	Bakery Owner	Walk	0 km	Brown's Bakery (Downstairs)

Database Concepts

owner_id	owner_name	address	dog_name	breed	dob	microchip
1	Joe Murphy	1 Main st.	rover	labrador	22/11/2011	Y
1	Joe Murphy	1 Main St.	fido	poodle	02/02/2020	Y
2	Ada Traore	9 Park Ave.	fido	jack russell	15/06/2015	N
1	Joe Murphy	1 Main St.	champ	greyhound	01/01/2010	Y
2	Ada Traore	9 Park Ave.	spots	dalmation	24/08/2007	N
3	James Tidy	7 Bond St.	buddy	rottweiler	21/10/2012	Y

How do add a new customer (unless they buy a dog)?

How do we update a record that occurs multiple times?

How do we ensure we don't delete too much information?

Primary Key

ID	fname	sname	address	...	email	...
1	Joe	Murphy	1 Main St.	...	jmurphy@outlook.ie	...
2	Ada	Traore	9 Park Ave.	...	at@gmail.com	...
3	James	Tidy	7 Bond St.	...	tidy@outlook.ie	...
4	Joe	Murphy	1 Park Ave.	...	murphyj@yahoo.com	...

Foreign Key

Foreign Key (FK): An attribute in a table that is used as a primary key in another table.

A FK provides the relationship by linking one table to another

dog_id	name	breed	dob	microchip	owner_id
1	rover	labrador	22/11/2011	Y	1
2	fido	poodle	02/02/2020	Y	1
3	fido	jack russell	15/06/2015	N	2
4	champ	greyhound	01/01/2010	Y	1
5	spots	dalmation	24/08/2007	N	2
6	buddy	rottweiler	21/10/2012	Y	3

Relational Model
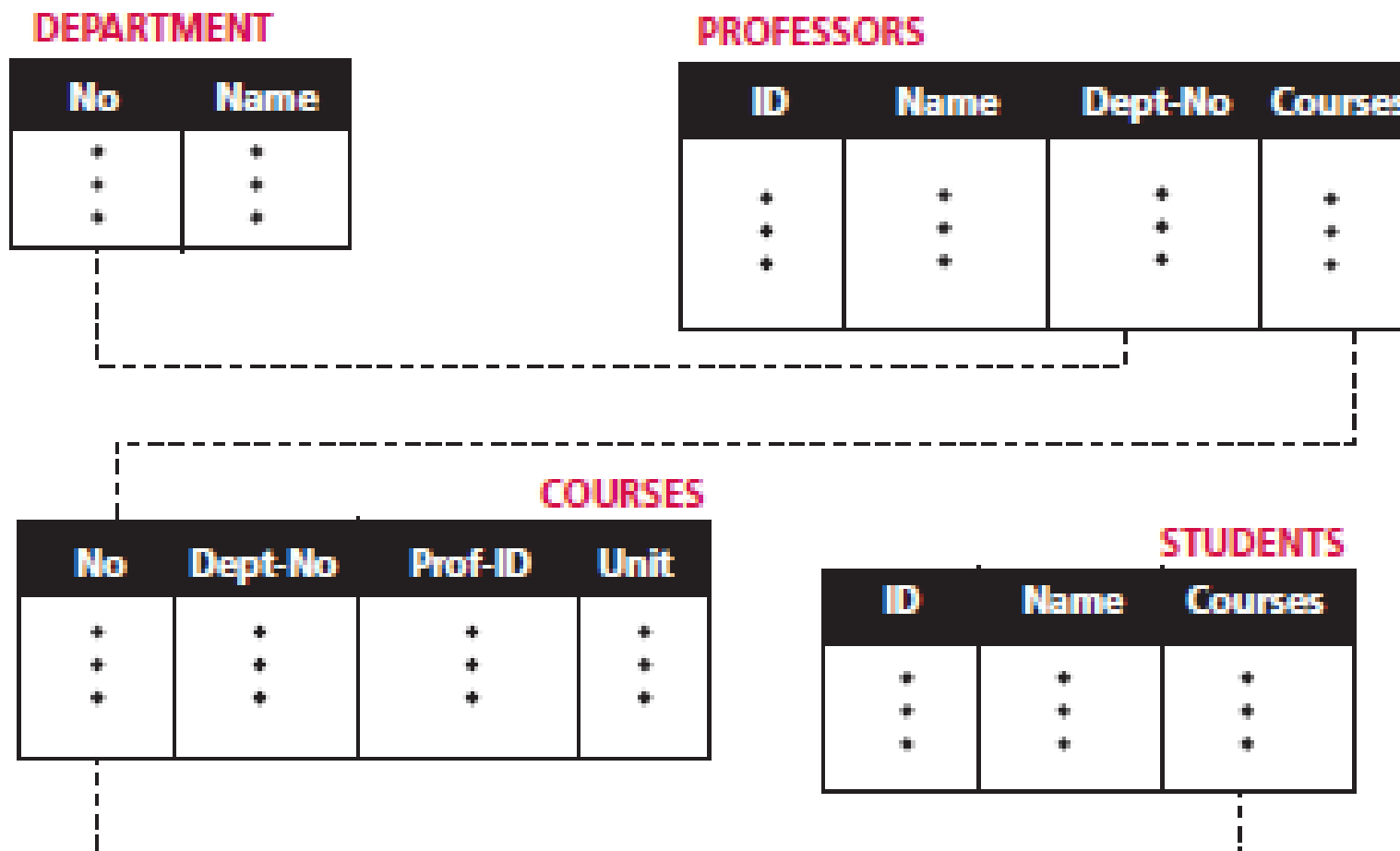
Structured Query Language (SQL) vs. NoSQL

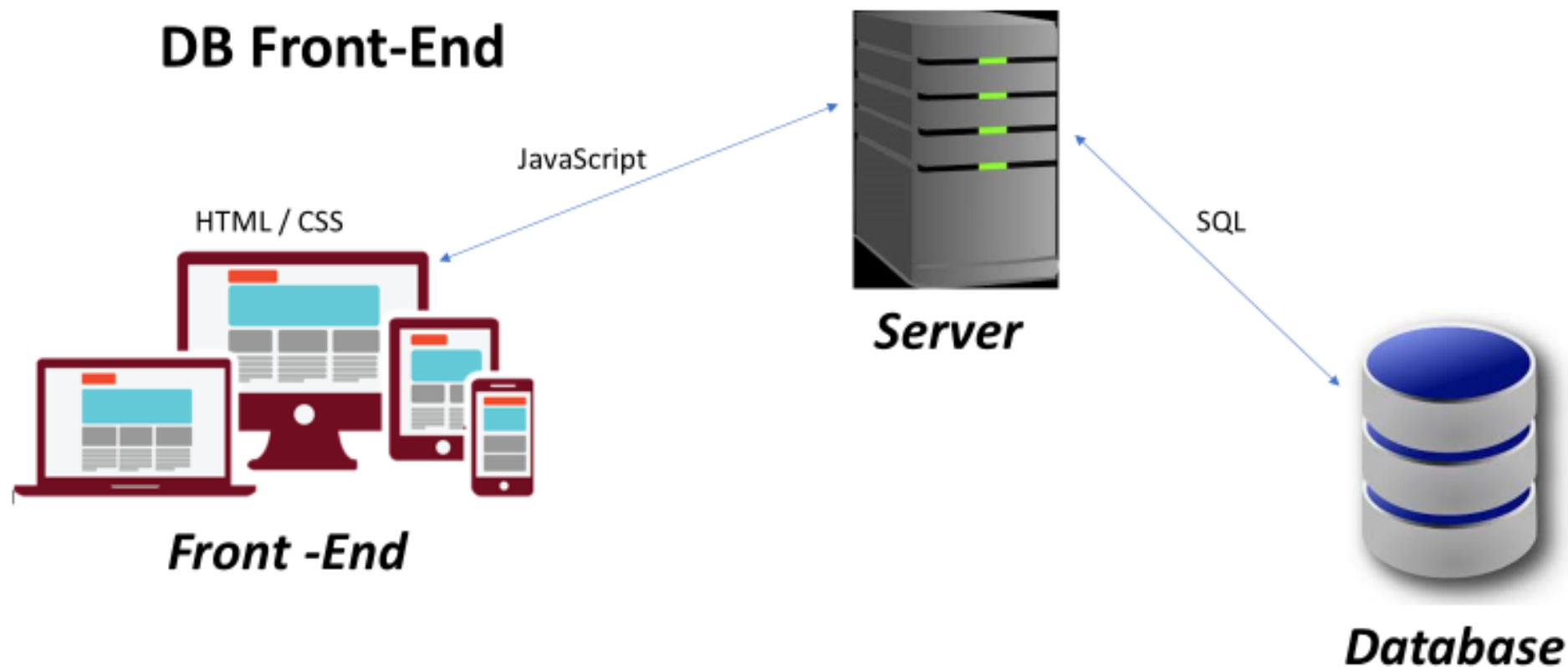| fname	sname	county	gender	email	news
Joe	Murphy	carlow	male	jmurphy@outlook.ie	Yes
Mary	Murphy	cavan	female	maary@gmail.com	No

Relational Model (SQL Based)

pdst-nw5-demo-project-default-rtdb

contacts

-MIE1MOcA-YTzdTQi1BO

county: "carlow"

email: "jmurphy@outlook.com"

fname: "Jim"

gender: "male"

news: 1

sname: "Murphy"

-MIE1XDuEB3XdaUhchFa

county: "cavan"

email: "maary@gmail.com"

fname: "Mary"

gender: "female"

news: 0

sname: "Murphy"

Cloud Model (NoSQL)

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Matching Exercise

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Some Database Solutions

micro:bit Data Logging

	time (source1)	
1		
2	0	28
3	4.76	28
4	9.52	28
5	14.28	28
6	19.04	28
7	23.8	30
8	28.559	31
9	33.32	31
10	38.08	31
11	42.839	31
12	47.599	31
13	52.359	31
14	57.119	30
15	61.879	30
16	66.64	30
17	71.4	30
18	76.161	29
19	80.919	29
20	85.678	29
21	90.439	29
22	95.198	29
23	99.958	29
24	104.719	28
25	109.478	28
26	114.238	28
27	118.997	28

Micro:bit temperature data
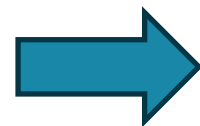
Data logging
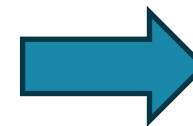
CSV file

micro:bit Data Logging


```
on start

serial redirect to USB


forever

show number    temperature (°C)

pause (ms)   5000

serial write line    temperature (°C)
```

Predict:

Predict what this code does

Run:

Open the makecode editor environment and run this code in the online simulator

Investigate:

Did anything change in the makecode editor environment?

Investigate what happens if you change the online temperature.

Investigate what happens if you click this icon.

Connect your micro:bit. What do you notice happens with the online simulator?

Modify:

Modify your code to log the outside temperature   HINT: `radio set group 10`

Make:

Consider how you could extend this task for your students. What could you ask them to make?

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micro:bit Data Logging

micro:bit Data to IoT Platform
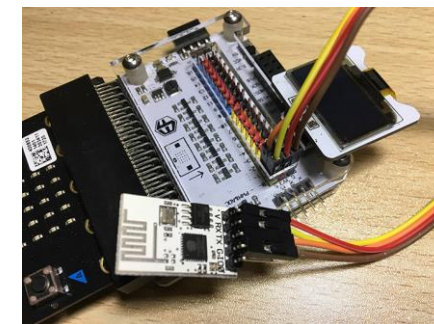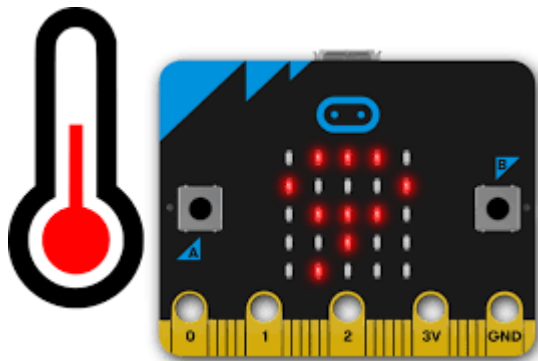

ESP8266 wifi module

Smarthon IoT Bit

Feed data from a sensor to a website using ThingSpeak


```
13    data1 = str(ser.readline())
14    data1 = data1.replace("b","")
15    data1 = data1.replace("'","")
16    data1 = data1.replace("\\r\\n","")
17    time.sleep(5)
18    print(data1)
19    msg = data1
20
21    b=urllib.request.urlopen('https:/
```

Add Visualizations   Add Widgets   MATLAB Analysis

Export recent data   MATLAB Visualization

Channel Stats

Created: 39 minutes ago
Last entry: about a minute ago
Entries: 5

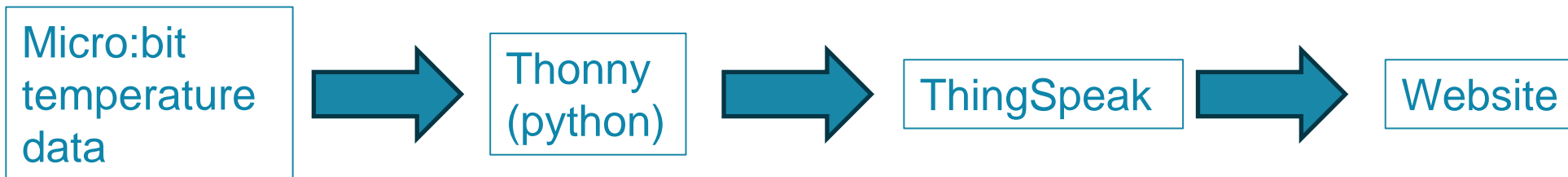Field 1 Chart

thonnyTest

Welcome to my website...

SMART HEATING

CUSTOMER   ADDRESS   TYPE

Mary Byrne	Dublin	Oil
Karl Stone	Kildare	Oil
Sarah Reilly	Cork	Gas
XXX	YYYY	Green
?	?	?
?	?	?

Temperature reading from a remote microbit

thonnyTest

| Micro:bit temperature data | → | Thonny (python) | → | ThingSpeak | → | Website |

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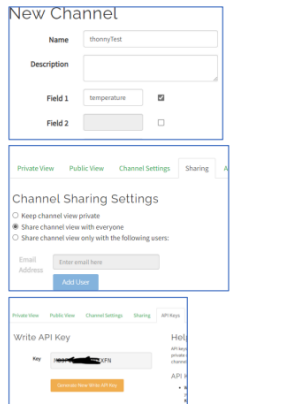Supporting the Professional
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ThingSpeak Activity

Micro:bit Data to ThingSpeak IoT Platform

Part 1: Setting up an account on ThingSpeak

a) Set up a ThingSpeak account
https://thingspeak.com/login
Create a channel.

b) Fill in one field and call it "temperature".

c) Channel Sharing Settings – Click on "Share channel view with everyone".

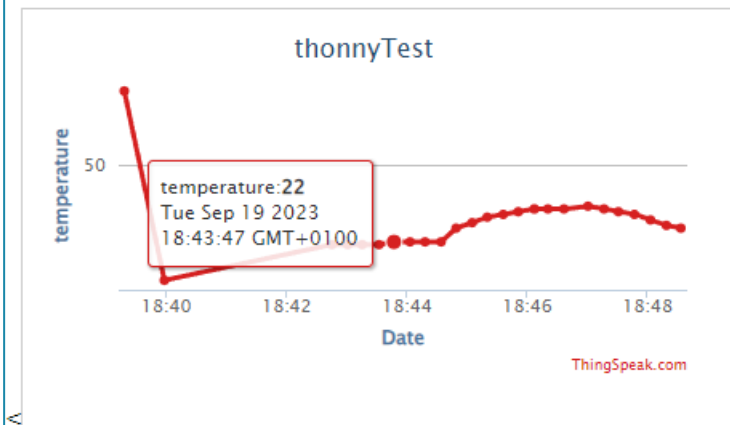d) Take a note of your API key – you will need this for the next part.

ThingSpeak.com

Welcome to my website...

SMART HEATING

CUSTOMER	ADDRESS	TYPE
Mary Byrne	Dublin	Oil
Karl Stone	Kildare	Oil
Sarah Reilly	Cork	Gas
XXX	YYYY	Green
?	?	
?	?	?

Temperature reading from a remote microbit

thonnyTest

temperature:22
Tue Sep 19 2023
18:43:47 GMT+0100

ThingSpeak.com

Measuring temperature remotely

Code for sender micro:bit

```
on start
    digital write pin P11 to 0
    show string "sender"
    radio set group 10

forever
    show number temperature (°C)
    radio send number temperature (°C)
    pause (ms) 5000
```

Code for receiver micro:bit

```
on start
    radio set group 10
    show string "receiver"
    serial redirect to USB

on radio received receivedNumber
    show number receivedNumber
    serial write value "celsius" = receivedNumber
```