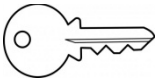# Cryptic Challenge

St. Paul's Catholic School, Milton Keynes
27th November 2014

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Department of Mathematics and Statistics

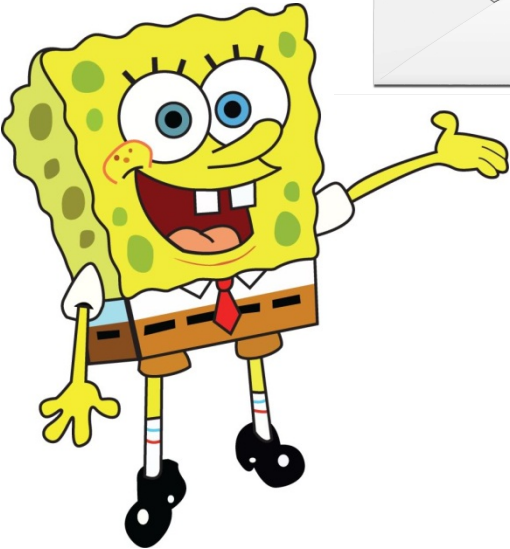The Open University, Milton Keynes

What is cryptography?

encrypt

decrypt

Bob

Alice

Bletchley Park

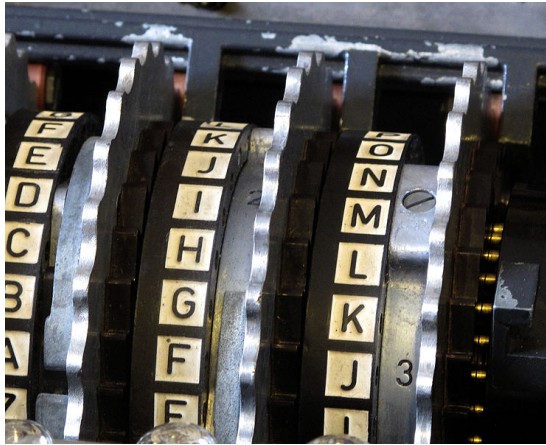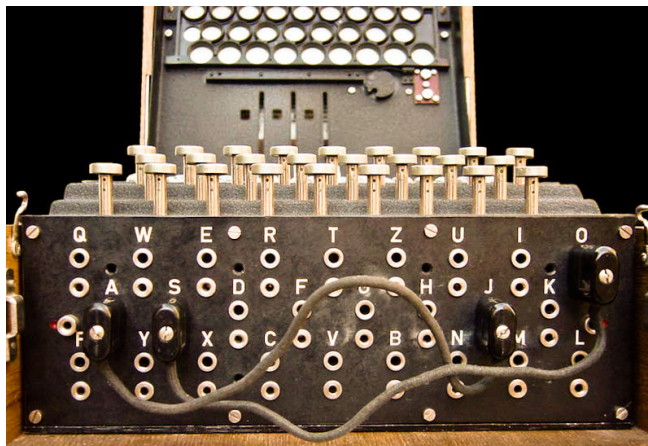## Milton Keynes

Enigma

158,962,555,217,826,360,000 configurations!

Choose 3 rotors
out of a set of 5,
60 possibilities.

Each rotor has
26 positions,
one for each letter.

Connect
10 pairs of
letters in the
plugboard.

Alan Turing

Wilmslow (Cheshire), 1912 – 1954
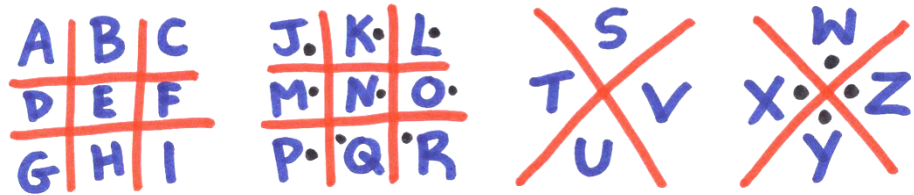
Starter activity

Crack the cypher to find out what we'll do today

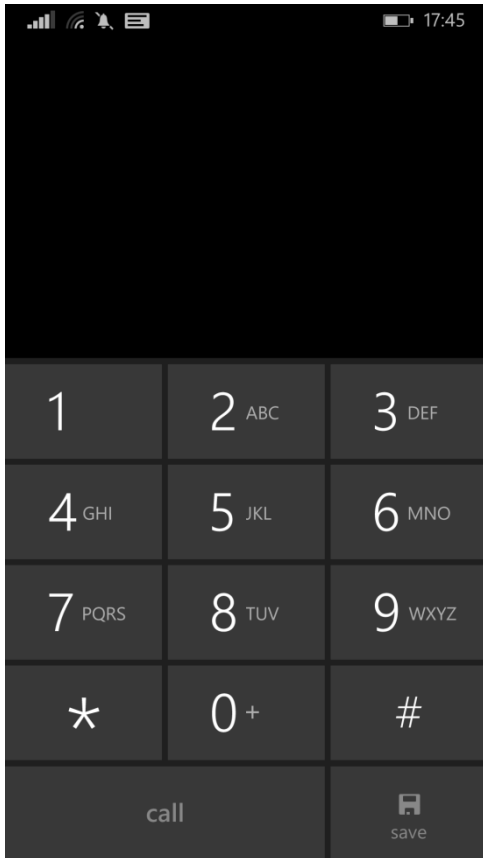# Starter activity

Crack the cypher to find out what we'll do today

By the end of this session you will be able to:

Decode messages using different cyphers.

Challenge 1

The texting challenge

Examples

927 = WAS/WAR

2628 = BOAT/COAT

4483 = GIVE/HIVE

Challenge 1

The texting challenge

Challenge 1: Decode the message

"9428 36 968 2255 2 74337 9484 66 5347?"

"2 25683!"

Challenge 1

The texting challenge

Challenge 1: The message says…

"What do you call a sheep with no legs?"

"A cloud!"

Challenge 2

The transposition challenge

We want to encrypt the message

"We are at St Paul's Catholic School"

First remove all punctuation and spaces

weareatstpaulscatholicschool

There are 28 letters. How can we factorise 28?

28 = 2 × 14 = 4 × 7

We'll choose 4 × 7

Challenge 2

The transposition challenge

We write our message in a 4 × 7 grid going along the rows

w	e	a	r
e	a	t	s
t	p	a	u
l	s	c	a
t	h	o	l
i	c	s	c
h	o	o	l

We read off the coded message going down the columns

"wetltiheapshcoatacosorsualcl"

Challenge 2

The transposition challenge

Suppose we want to decode the message

"ckatsoenaadekifepdlesbesr"

We need to put the text back into the grid. But how big should the grid be?

The message is 25 letters long. There is only one factorisation of 25, 5×5.

Now we can crack the cypher!

Challenge 2

The transposition challenge

This time we write the message going down the columns

c	o	d	e	s
k	e	e	p	b
a	n	k	d	e
t	a	i	l	s
s	a	f	e	r

Then we read off the message going along the rows

"Codes keep bank details safe"

Challenge 2

The transposition challenge

Challenge 2: Decode the message

"trmsimhlatsledld1 owslo5nosegcg"

Hint: You might have to try different grids!

Challenge 2

The transposition challenge

Challenge 2: The message says…

"The world's smallest dog is 15cm long"

Challenge 3

The binary challenge

Computers code messages in the binary language.

A = 1 = 00001   H = 8 = 01000

B = 2 = 00010   I = 9 = 01001

C = 3 = 00011   J = 10 = 01010

D = 4 = 00100   K = 11 = 01011

E = 5 = 00101   L = 12 = ?
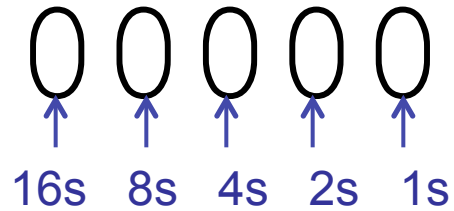
F = 6 = 00110   M = 13 = ?

G = 7 = 00111   N = 14 = ?

Challenge 3

The binary challenge

How do we get from a binary number to a letter?

0 0 0 0 0
↑ ↑ ↑ ↑ ↑
16s 8s 4s 2s 1s

1 0 1 0 1
↑ ↑ ↑ ↑ ↑
16 + 0 + 4 + 0 + 1
= 21 = U

Challenge 3

The binary challenge

What are the following letters?

01110

00010

10111

11001

Challenge 3

The binary challenge

Challenge 3: Decode the message

"00011 01111 01101 10000 10101 10100
00101 10010 10011 10110 01001 00101
10111 00101 10110 00101 10010 11001
10100 01000 01001 01110 00111 00001
10011 01111 01110 00101 10011 00001
01110 00100 11010 00101 10010 01111
00101 10011 11011"

Challenge 3

The binary challenge

Challenge 3: The message says…

"Computers view everything as ones and zeroes!"

Challenge 4

How might you crack a substitution cypher if you don't know which substitutions have been made?

Challenge 4

???

Frequency Analysis of Letters Used in the English Language
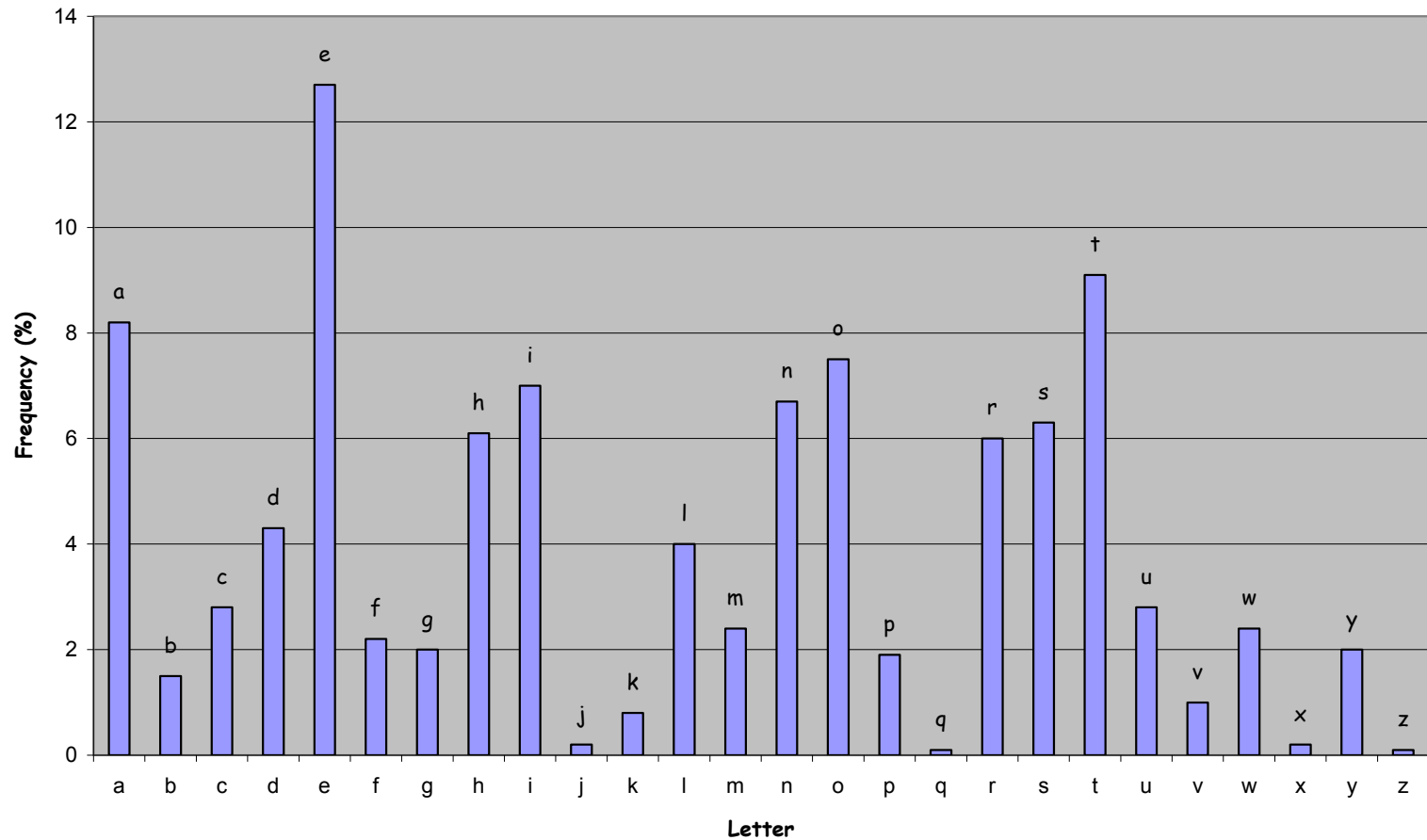
Challenge 4

The frequency analysis challenge

Challenge 4: Decode the message

"IHU EUTI NYSU NLRNKULT MYJI
PGQU WF RJS RAMRVT MRJI IY
BGJS IHU RJTMUL. YBIUJ IHULU
GT R LUMRLS BYL IHYLU MHY
TWNNUUS."

Challenge 4

The frequency analysis challenge

Challenge 4: The message says…

"The best code crackers won't give up and always want to find the answer. Often there is a reward for those who succeed."

The ALAN TURING Cryptography Competition

by University of Manchester

http://www.maths.manchester.ac.uk/cryptography_competition/

The Imitation Game
…in cinemas now!

Thanks to:

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