



STATE DA VINCI DECATHLON 2018

CELEBRATING THE ACADEMIC GIFTS OF STUDENTS
IN YEARS 5 & 6



CODE BREAKING - SOLUTIONS

TEAM NUMBER _____

1	2	Total	Rank
/26	/23	/49	

BREAKING THE CODE BARRIER – FROM INFORMATION TO FUNCTION (26 MARKS)

The first section of this code breaking paper takes an unexpected look at a different type of code breaking. We will no longer be viewing codes simply as a way to encrypt **information**. Now, we will be examining how we can encrypt and organise **function** by developing a system of coding. The following tasks will ask you to decrypt a system of rules, the code, to determine whether a desirable outcome might be achieved. Other tasks may ask you to develop an encryption to bring about a desirable outcome.

NOTE: only your work in the answer boxes (orange/white) will be marked in this paper!

QUESTION 1 (4 MARKS)

1. Table the algorithm with an input of the list: **hand, eye, nose, face** and

Step 1. Swap places with the 1st and 4th items on the list.

Step 2. Swap places with the 1st and 2nd items on the list.

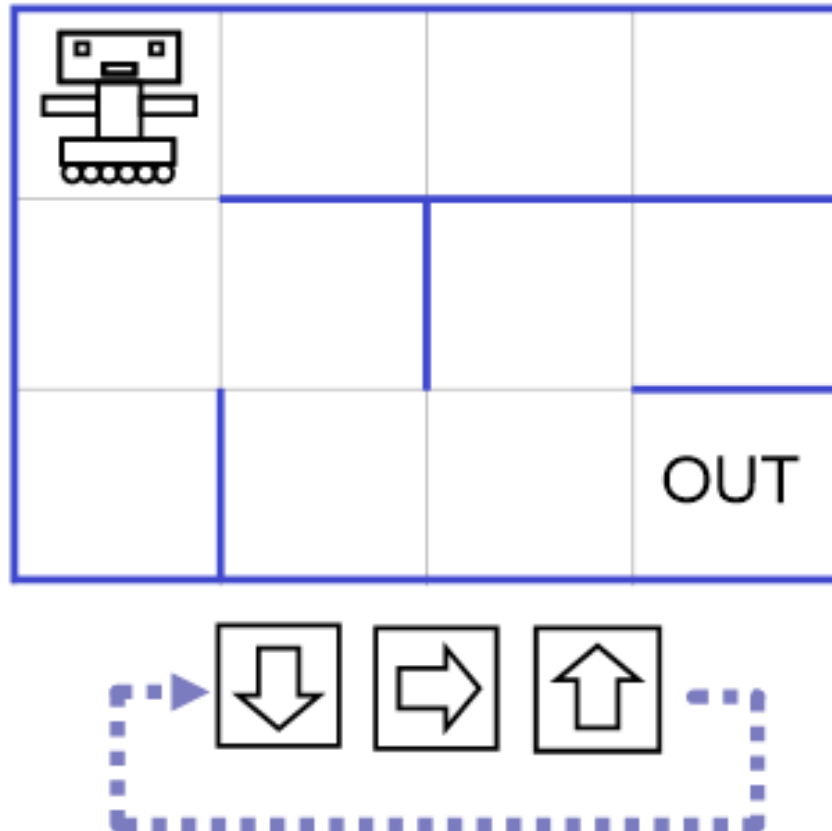
Step 3. If the 4th item starts with a letter closer to Z compared to the starting letter of the 3rd item, switch the items.

Step 3. End.

What will be the list at Step 3?

Escape?	Eye, face, nose, hand – 1 mark each
---------	-------------------------------------

QUESTION 2 (6 MARKS)

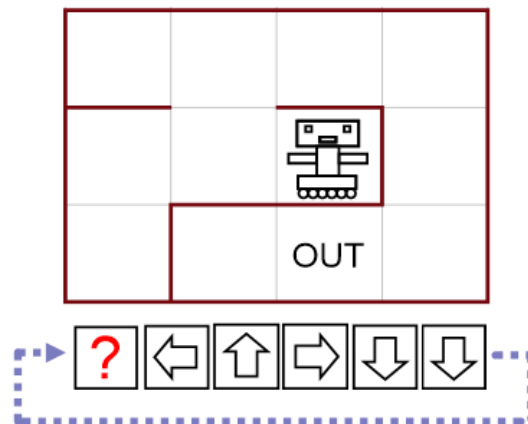


Dobby the Robot elf is programmed with a series of direction commands; each command causes Dobby to either move one step (if a move is possible in that direction) or not move at all (if a move is not possible). At the end of a sequence Dobby repeats it from the beginning.

Dobby escapes as soon as he steps on the square marked "out". Dobby is in the maze shown above with the program indicated. Will Dobby be able to get out? Show your working on the image above, otherwise marks will not be rewarded.

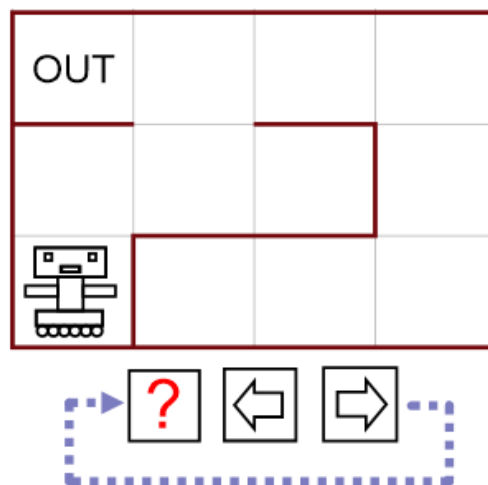
Escape?	<p>YES he will escape - 6 marks for correct with working; 3 marks if correct but no evidence of working, 0 if yes. Note: You don't need to follow working, just cite that there is working (this applies to all questions in this paper)</p>
---------	---

QUESTION 3 (6 MARKS)



Dobby is in the same situation as the previous problem. Dobby can get out with the program shown, except one of the cards is missing. Which type of card goes at the question mark? (3 marks)

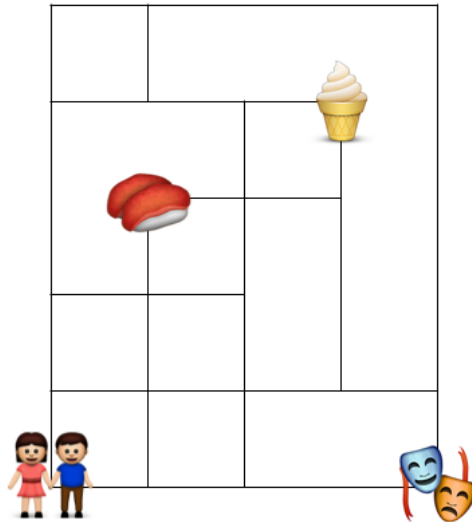
Left/right/up/down	Right – 3 marks if correct; 0 otherwise
--------------------	--



Dobby is in the same situation as the previous problem. Dobby can get out with program shown, except one of the cards is missing. Which type of card goes at the question mark? (3 marks)

Left/right/up/down	UP – 3 marks if correct; 0 marks otherwise
--------------------	---

QUESTION 4 (4 MARKS)



Karla and Kenny live in the southwest corner of a town, whose roads are laid out in a grid. They decided to head out for an evening to either the comedy club, ice cream shop or sushi restaurant. If they walked around based on the following rules, where is the first place that they will end up?

- Step A: If possible, move north 1 block then proceed to step B. Otherwise, stop moving.
- Step B: If possible, move east 1 block, then proceed to step A. Otherwise, stop moving.

Note: One block means one side length of the squares in the grid.

Location	Comedy club – 4 marks of correct with working shown; 2 marks if correct but no working; 0 marks if anything else
----------	---

QUESTION 5 – LINKS AND CHAINS (6 MARKS)

a)

$A \rightarrow B \rightarrow C$

$D \rightarrow E$

$F \rightarrow G \rightarrow H$

Three lists are shown above.

If two new connections are made, **H to A** and **E to F**, a single linked list can be formed.

Which list is now the correct list? (3 marks)

List 1

$D \rightarrow E \rightarrow A \rightarrow B \rightarrow C \rightarrow F \rightarrow G \rightarrow H$

List 2

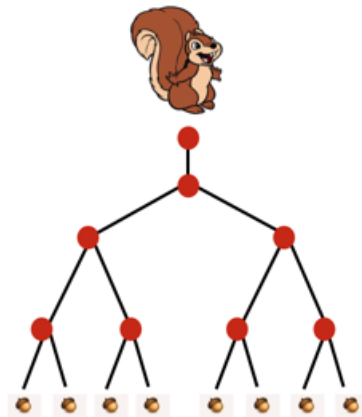
$F \rightarrow G \rightarrow H \rightarrow A \rightarrow B \rightarrow C \rightarrow D \rightarrow E$

List 3

$D \rightarrow E \rightarrow F \rightarrow G \rightarrow H \rightarrow A \rightarrow B \rightarrow C$

List Number	List 3 – 3 marks or 0
-------------	-----------------------

b)



Each edge in the binary tree has length 1. What is the minimum distance that the squirrel must travel to collect all 8 acorns? (3 marks)

Answer	26 – 3 marks if correct; 0 marks otherwise
--------	--

2. CAREFUL CODING (23 MARKS)

1. An ancient box is found with the following numbers on the outside '9 23 14 14 18 5'. There is a lock with 6 scrollable columns to select a letter for each column. Decode the letters (in the correct order) that will unlock the box. (6 marks)

Decryption

WINNER (CEASER SHIFT) – 1 mark for each correct letter (6 in total)

2. You have received a sudden alert on your phone from the Darkside. It appears to be nonsense, and perhaps you are dreaming, it is 4 minutes past midnight in the morning after all. Can you decode the message? (5 marks)

WTARANKKSLPKTKVVHEIVILLASPTEABVVSIOIGEPTFRBBOEPEVNBBDPREIREIPS
IRIFJKDCANOWORULPLSKKPDLLQITARSNLKCIUEOSSKVQUIENNIRLLKYL

Decryption

WAS THIS A SERENDIPIDOUS DISCOVERY? (EVERY FOURTH LETTER, THREE NONSENSE LETTERS BETWEEN EACH) – 1 mark for each word (5 in total)

3. Decode the following unusual messages:

Message	Decryption (3 marks each)
<p>roolf eht ot deppils ylneddus maerc eci reh sa dias ehs on ho</p>	<p>Note – 1 mark off each word in error oh no she said as her ice cream suddenly slipped to the floor</p>
<pre> / - / - / - - - / / - - - - . / - </pre>	<p>alert alert the philigozolop is on route</p>
<p>Bbslppdnbnrndthdncwntbnns</p>	<p>Bob slipped on the banana and the audience went bananas</p>
<p>ho on ti si ydaeria eht dne fo eht repap</p>	<p>Oh no it is already the end of the paper</p>