

Solution to the ASD 75th Anniversary 50c Coin Challenge

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Change log

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1. Document started.

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1. Appendix about the ASD-alphabet added.

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Chapter 1

Introduction



Figure 1.1: Coin side A



Figure 1.2: Coin side B

The coin is issued in the event of the Australian decoding team, Australian Signals Directorate (ASD), 75th anniversary 1947 - 1922. It is engraved with a number of puzzles, decoding problems, which can be solved without being a cryptography expert. The easier side is the B-side. It has only one challenge, whereas the A-side has five. Some of the challenges give a hint to the next.

Chapter 2

The Challenges

2.1 Challenge 1

Starting on the B-side, it is seen that 6 letters have a Braille code underneath the letter. The codes are B-3, T-2, H-6, A-1, S-5 and A-4. Reordering the 6 letters gives the word ATBASH, which is the name, among others, for the ancient coding system where the letters in a text are mirrored over the alphabet, i.e. using the english alphabet replace A by Z, B by Y etc.

2.2 Challenge 2

Looking at the A-side of the coin, it has an outer ring of characters:

DVZIVZFWZXRLFHRMXMLXVKGZMWNVGRXFOLFHRMVCVXFGRLM●
URMWXOZIRGBRM7DRWGSC5WVKGS●

Using the Atbash decoding scheme, the text reads:

WEAREAUDACIOUSINCONCEPTANDMETICULOUSINEXECUTION●
FINDCLARiTYIN7WIDTHX5DEPTH●

or

We are audacious in concept and meticulous in execution. Find clarity in 7 width x 5 depth.

2.3 Challenge 3

The characters in the outer ring have three shades of gray: white, gray and black. Note that the two small disk circles separating the last part are also colored.

Replacing the white, gray and black characters with W, G and B we get:

BWWWGWWWWBGBBBBWGWWBBBGG
WBBGBBBGWBBBGBWGBWBBGWBBBGBGBWBGWGBWWBGBWGBWBGWBGW

Looking closely at the character string, it is seen that Morse code is the solution. By replacing the B's by a · and the W's by a – and using the G's as characters separators we have:

1947 DSBALBERTPARK

or

1947 DSB Albert Park

2.7 Challenge 7

This is a curio, since the solution may not have been intended. As mentioned in 2.1 the B-side has six character marked with dots:

B	T	H	A	S	A
•	•	•	•	•	•
	•	•		•	•
	•	•			•

On the A-side at the center of the lower part, a small engraving can be found (see Appendix A):



The engraving is divided into six sections like the characters above and resembles the dots below the six characters:

B	T	H	A	S	A
	•	•	•	•	•
	•	•	•	•	•

The dots are organized in a 2 by 2 matrix and it is tempting to view each matrix as a number in the range 0 - 15, but it is not obvious how the weights 1, 2, 4, 8 should be distributed, giving 24 possibilities. It is assumed that the distribution is the same for all the matrices below the characters and that the engraving has its own distribution of weights. The following matrices are thus assumed:

B	T	H	A	S	A
11	10	11	10	10	11
00	10	10	00	01	01

and for the engraving:

B	T	H	A	S	A
00	11	01	11	00	11
00	11	00	11	00	10

and the engraving upside down:

B	T	H	A	S	A
01	00	11	00	11	00
11	00	11	10	11	00

It is now assumed that the decoding is done by combining the ASCII value of each of the six characters C_n^p , BTHASA, with the value of the corresponding matrix $M1_n^p$, one of the two engraving matrices $M2^p a_n$ and $M2^p b_n$ values and an offset O in the range 0 - 25, the value being wrapped within the alphabet. This gives the following possibilities:

$$\begin{array}{rclcl}
 C_0^p & + & M1_0^p & + & M2a_0^p & + & O \\
 C_1^p & + & M1_1^p & - & M2a_1^p & + & O \\
 C_2^p & - & M1_2^p & + & M2a_2^p & + & O \\
 C_3^p & - & M1_3^p & - & M2a_3^p & + & O \\
 C_4^p & + & M1_4^p & + & M2b_0^p & + & O \\
 C_5^p & + & M1_5^p & - & M2b_1^p & + & O \\
 C_6^p & - & M1_6^p & + & M2b_2^p & + & O \\
 C_7^p & - & M1_7^p & - & M2b_3^p & + & O
 \end{array}$$

p being a number between 0 and 5.

The total number of possible six letter words is thus: $8 * 24 * 24 * 26 = 119808$. The words are not unique and can be reduced to 59904 candidates. When the MS Word OLE interface spelling checker is used on these words, only one is recognized as an English word: HOORAY. This is regarded as the solution.

The matrix combination is $C_5^p + M1_5^p - M2b_1^p$, i.e. the engraving must be viewed upside down. The weight for $M1_5^p$ is:

$$\begin{array}{r}
 8 \ 1 \\
 2 \ 4
 \end{array}$$

and for $M2b_1^p$:

$$\begin{array}{r}
 1 \ 4 \quad 1 \ 8 \\
 2 \ 8 \ \text{or} \ 2 \ 4
 \end{array}$$

The offset $O = 11$.

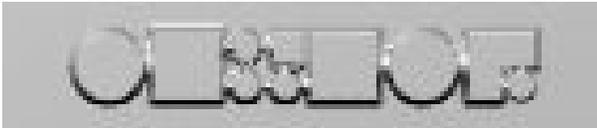
This gives the following table:

B	T	H	A	S	A	
66	84	72	65	83	65	
9	10	11	8	12	13	
-14	-0	-15	-2	-15	-0	
11	11	11	11	11	11	
72	79	79	82	65	89	some values are wrapped
H	O	O	R	A	Y	

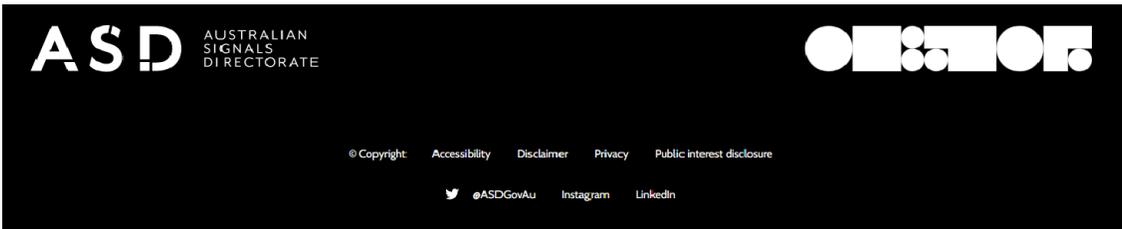
Chapter 3

Apendix A

On the A-side at the center of the lower part, a small engraving can be found:



It is the ASD logo also found on their web site:



The logo consists of three letters from the ASD-alphabet:



A B C D E F G H I



J K L M N O P Q R



S T U V W X Y Z

It is not yet clear how the alphabet is constructed.