

## Specialist Investigation Practice Test

[Total marks: 36]

Question 1)

[6 marks]

There is a certain 6-permutator bought by a customer.

a) How many different 6-permutators are there

[1 mark]

b) How many 6-permutators will swap the characters within exactly 2 pairs.

[2 marks]

How many loop lengths of 2 and 3 are there in a 12-permutator.

c) How many 6-permutators are there with the loop length of 6.

[3 marks]

Question 2)

[4 marks]

There is a 7-permutator  $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 2 & 1 & 3 & 4 & 6 & 7 & 5 \end{pmatrix}$  and a certain 7-character word that has no repeated characters.

a) How many internal loops are in this 7-permutator.

[2 marks]

b) How many operations will it take to go from the 7-character word back to it.

[2 marks]

Question 3)

[3 marks]

John Penis is given the 8-permutator  $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 4 & 5 & 1 & 2 & 3 & 8 & 6 & 7 \end{pmatrix}$ . He, in a silly manner, descrambles a certain 8 character word. After the first 2 operations he has the scrambled word { D S U C K ! ? I }. John wants to descramble the word back to its original form. How many operations will he have to go through until he gets the original word back and what is this word?

Question 4)

[3 marks]

Nonar is given an 8-permutator with a loop length of 12. How many different 8-permutators are there such that there is a loop length of 12.

Question 5)

[5 marks]

a) Show examples of a 6-permutator which has a loop length of 2, 3, 4 and 5.

[2 marks]

b) Are there other ways of having a 6-permutator with a loop length of 2. If yes, how many are there.

[3 marks]

Question 6)

[3 mark]

Druv and Gargamel are given a 15-permutator that has loop lengths of 4, 3 and 8. In order to save smurfville, Druv challenges Gargamel to who can find the minimum number of operations needed to get back to the original word. How can Druv find this before Gargamel to save smurfville and how will his method work?

Question 7)

[7 marks]

- a) For a prime number  $k$ , show a generalised formula to calculate the number of different permutations of a  $n$ -permutator.

[2 marks]

- b) How many different permutations of loop lengths of 2 and 3 are there in a 12-permutator.

[5 marks]

Question 8)

[5 marks]

A customer is given a 7-permutator and a 8-permutators:  $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 7 & 3 & 1 & 4 & 2 & 5 & 6 \end{pmatrix}$  and  $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 6 & 5 & 3 & 7 & 2 & 8 & 4 & 1 \end{pmatrix}$ .

a) State the minimum number of operations to get back the original word for each permutator and show how you got this. [2 marks]

b) How many operations will both permutators have to go through until a 7 and 8 character word are back to their original form? Provide reasoning. [2 marks]