Question 1 answer:

* output: `Total keyspace: 41287680, Number of valid keys 322560`

Question 2 answer:

* output: `Total keyspace: 41287680, Number of valid keys 1440`

Question 3 answers:

* output:
  + `Original ciphertext: 0000111010011011001001110100
  + Bit 1 changed: 1 bits different in ciphertext
  + Bit 2 changed: 3 bits different in ciphertext
  + Bit 3 changed: 1 bits different in ciphertext
  + Bit 4 changed: 1 bits different in ciphertext
  + Bit 5 changed: 2 bits different in ciphertext
  + Bit 6 changed: 2 bits different in ciphertext
  + Bit 7 changed: 2 bits different in ciphertext
  + Bit 8 changed: 1 bits different in ciphertext
  + Bit 9 changed: 1 bits different in ciphertext
  + Bit 10 changed: 2 bits different in ciphertext
  + Bit 11 changed: 1 bits different in ciphertext
  + Bit 12 changed: 2 bits different in ciphertext
  + Bit 13 changed: 3 bits different in ciphertext
  + Bit 14 changed: 2 bits different in ciphertext
  + Bit 15 changed: 1 bits different in ciphertext
  + Bit 16 changed: 1 bits different in ciphertext
  + Bit 17 changed: 1 bits different in ciphertext
  + Bit 18 changed: 1 bits different in ciphertext
  + Bit 19 changed: 4 bits different in ciphertext
  + Bit 20 changed: 3 bits different in ciphertext
  + Bit 21 changed: 2 bits different in ciphertext
  + Bit 22 changed: 1 bits different in ciphertext
  + Bit 23 changed: 1 bits different in ciphertext
  + Bit 24 changed: 1 bits different in ciphertext
  + Bit 25 changed: 1 bits different in ciphertext
  + Average number of bits changed: 1.64`

(d): For the given 25-bit plaintext input, the average number of bits changed in the ciphertext when flipping a single bit in the plaintext is 1.64.

The diffusion property of this block cipher is moderate. In an ideal scenario with perfect diffusion, changing one bit in the plaintext should change about half of the bits in the ciphertext. For a 7-bit block (as used in this cipher), we expect an average of 3.5 bits to change.

With an average of 1.64 bits changing, this cipher does exhibit some diffusion, but it is not as strong as it could be for optimal security. This means that changes in the plaintext are not propagating through the ciphertext as extensively as desired, potentially making the cipher more vulnerable to certain types of cryptanalysis.

(e): Considering the results from questions 1, 2, and 3, we can assess the strength of this block cipher as follows:

1. From Question 1: Out of 41,287,680 possible keys, 322,560 keys (about 0.78%) produce the correct ciphertext for a single plaintext-ciphertext pair. This relatively high percentage suggests that the cipher might be vulnerable to known plaintext attacks.

2. From Question 2: When considering two plaintext-ciphertext pairs, the number of valid keys reduces to 1,440. While this is a significant reduction, it still leaves many possible keys, making exhaustive search challenging but possible with modern computing power.

3. From Question 3 (diffusion property): The average of 1.64 bits changing in the ciphertext for a single bit change in the plaintext indicates that the cipher does provide some diffusion, but it is not as strong as desired for a highly secure cipher.

Conclusion on strength:

This block cipher shows some significant weaknesses:

1. Keyspace vulnerability: The key space is relatively small, and a significant portion of keys (0.78%) work for a single plaintext-ciphertext pair, a security concern.

2. Multiple plaintext-ciphertext pairs: Even with two known plaintext-ciphertext pairs, there are still many valid keys, although the reduction is substantial.

3. Moderate diffusion: The diffusion property is present but not very strong, which could make the cipher vulnerable to certain types of attacks.

While this block cipher provides some security features, it has significant weaknesses that make it unsuitable for high-security applications. It might be suitable for low-security scenarios, but a more robust cipher with better diffusion properties and a larger key space would be recommended for sensitive information.