DOOR AND BOMB CODES SOLUTION

QUESTION 1

$$Total\ possible\ combinations\ =\ possible\ numbers\ per\ digit^{number\ of\ digits}$$

$$Total\ possible\ combinations\ =\ 12^7$$

$$\boldsymbol{Total\ possible\ combinations\ =\ 3.58 \times 10^7}$$ **(1 mark)**

To work out the maximum time to crack the code trying 1000 possibilities a second:

$$Max\ time\ to\ crack\ = \frac{total\ number\ combinations}{tries\ per\ second}$$

$$Max\ time\ to\ crack\ = \frac{3.58 \times 10^7}{1000000}$$

$$Max\ time\ to\ crack\ =\ 3.58 \times 10^4\ =\ \boldsymbol{9.94\ hours}\ (1\ mark)$$

QUESTION 2

The total number of possible combinations is:

$$Total\ possible\ combinations\ =\ possible\ numbers\ per\ digit^{number\ of\ digits}$$

$$Total\ possible\ combinations\ =\ 10^4$$

$$Total\ possible\ combinations\ =\ 10000$$

At one code per second, we can calculate how many codes they can test in 1 hour and 5 minutes:

$$Number\ of\ codes\ testable\ = time\ left \times tests/second$$

$$Number\ of\ codes\ testable\ =\ 3900 \times 1$$

$$\boldsymbol{Number\ of\ codes\ testable\ =\ 3900\ codes}$$ **(1 mark)**

3900 is 39% of the 10000 possible codes. So if this scenario was run over and over again, in 39% of scenarios would they find the correct code before the bomb blows up. **(1 mark)**

QUESTION 3

The question asks for the maximum time possible, which means that we can assume they have to try all 10000 possible codes before the crack it. 10000 codes will result in 10000 / 5 = 2000 lots of 30 second time outs.

$$Maximum\ time\ to\ crack\ with\ timeouts = code\ entering\ time + time - out\ time$$

$$Maximum\ time\ to\ crack\ with\ timeouts\ =\ 10000\ s\ +\ 2000 \times 30s$$

$$\boldsymbol{Maximum\ time\ to\ crack\ with\ timeouts\ =\ 70000\ s = 19.4\ hours}$$ **(1 mark)**

Comment: The time out makes a very large difference to the maximum time – without the timeout the maximum time is just 10000s or about 2.8 hours, but with the timeout this maximum time blows out to 19.4 hours. **(1 mark)**

QUESTION 4

We need a code made up of the 95 ASCII printable characters that has at least the 3.58×10^7 possible codes for the security system in Question 1:

$$\boldsymbol{95^{required\ number\ of\ digits} = 3.58 \times 10^7}$$ **(1 mark)**

We can use logarithms to work this out directly:

$$\log\left(95^{required\ number\ of\ digits}\right) = \log(3.58 \times 10^7)$$

$$Required\ number\ of\ digits \times log(95)\ =\ \log(3.58 \times 10^7)$$

$$Required\ number\ of\ digits\ =\ 3.82\ digits$$

Since the question asks for a code that is *at least* as secure, we need to round up the digits to 4. **(1 mark)**

With more character options, you can maintain security with fewer digits, at least from brute force attacks.