

Q2 - (You can find the code in mappingFunction.cpp, this pdf is to show my logic to each question)

a) I've noticed that the output consists of alphanumerics, including the upper case and lowercase letters. From this quick observation, we can say that we can have up to 62 alphanumerics for each letter of the output.

1) Finding the first character(rightmost letter)

- There is a certain order of alphanumeric sequences that are determined by the (input % 62)
- From the following table
 - Left most column is the result of (input % 62) from 1st to 75th input on the spreadsheet
 - Second column is the corresponding rightmost alphanumeric character of the output
 - From the first and second columns, we can note that same input numbers correspond to same alphanumerics

| Input % 62 | Rightmost character | No duplicate and chronologically ordered (Input % 62) | Rightmost character |
|------------|---------------------|---|---------------------|
| 30 | p | 2 | x |
| 35 | W | 3 | i |
| 23 | 3 | 4 | c |
| 24 | B | 5 | P |
| 50 | R | 6 | M |
| 14 | N | 7 | G |
| 52 | g | 8 | v |
| 42 | 4 | 9 | z |
| 50 | R | 10 | A |
| 6 | M | 13 | T |
| 39 | L | 14 | N |
| 61 | k | 16 | d |
| 32 | E | 18 | w |
| 57 | r | 19 | n |
| 58 | K | 22 | D |
| 16 | d | 23 | 3 |
| 13 | T | 24 | B |
| 2 | x | 25 | 6 |
| 5 | P | 26 | H |

| | | | |
|----|---|----|---|
| 36 | 9 | 27 | 0 |
| 44 | j | 28 | O |
| 36 | 9 | 29 | u |
| 34 | 1 | 30 | p |
| 28 | O | 31 | 8 |
| 55 | F | 32 | E |
| 59 | I | 33 | 2 |
| 35 | W | 34 | 1 |
| 36 | 9 | 35 | W |
| 37 | s | 36 | 9 |
| 38 | q | 37 | s |
| 39 | L | 38 | q |
| 40 | Q | 39 | L |
| 9 | z | 40 | Q |
| 61 | k | 42 | 4 |
| 33 | 2 | 44 | j |
| 3 | i | 45 | S |
| 29 | u | 46 | e |
| 30 | p | 50 | R |
| 39 | L | 51 | J |
| 13 | T | 52 | g |
| 14 | N | 53 | a |
| 31 | 8 | 54 | f |
| 32 | E | 55 | F |
| 33 | 2 | 57 | r |
| 33 | 2 | 58 | K |
| 34 | 1 | 59 | I |
| 54 | f | 60 | b |
| 53 | a | 61 | k |
| 29 | u | | |
| 28 | O | | |
| 46 | e | | |
| 52 | g | | |
| 16 | d | | |
| 26 | H | | |
| 27 | 0 | | |
| 28 | O | | |

| | | | |
|----|---|--|--|
| 32 | E | | |
| 25 | 6 | | |
| 18 | w | | |
| 19 | n | | |
| 22 | D | | |
| 13 | T | | |
| 3 | i | | |
| 4 | c | | |
| 51 | J | | |
| 60 | b | | |
| 38 | q | | |
| 9 | z | | |
| 10 | A | | |
| 7 | G | | |
| 8 | v | | |
| 45 | S | | |
| 18 | w | | |
| 58 | K | | |
| 59 | I | | |

Table1

2) Finding the second character(middle letter)

- Has the same mechanism as the finding the first character, but it takes the quotient value and modulo 62 $[(\text{Input} / 62) \% 62]$

| $(\text{Input} / 62) \% 62$ | Second Character | No duplicate and chronologically ordered $[(\text{Input} / 62) \% 62]$ | Second Character |
|-----------------------------|------------------|--|------------------|
| 7 | G | 0 | C |
| 17 | m | 1 | 7 |
| 41 | X | 2 | x |
| 41 | X | 4 | c |
| 56 | t | 5 | P |
| 61 | k | 7 | G |
| 20 | V | 9 | z |
| 22 | D | 10 | A |
| 24 | B | 11 | Z |

| | | | |
|----|---|----|---|
| 43 | Y | 13 | T |
| 45 | S | 14 | N |
| 47 | U | 16 | d |
| 49 | I | 17 | m |
| 52 | g | 18 | w |
| 52 | g | 19 | n |
| 58 | K | 20 | V |
| 20 | V | 22 | D |
| 14 | N | 24 | B |
| 18 | w | 26 | H |
| 20 | V | 28 | O |
| 10 | A | 29 | u |
| 28 | O | 33 | 2 |
| 29 | u | 36 | 9 |
| 4 | c | 39 | L |
| 5 | P | 40 | Q |
| 26 | H | 41 | X |
| 39 | L | 43 | Y |
| 40 | Q | 45 | S |
| 40 | Q | 46 | e |
| 40 | Q | 47 | U |
| 40 | Q | 48 | h |
| 40 | Q | 49 | I |
| 4 | c | 52 | g |
| 29 | u | 53 | a |
| 48 | h | 56 | t |
| 49 | I | 58 | K |
| 53 | a | 61 | k |
| 53 | a | | |
| 56 | t | | |
| 1 | 7 | | |
| 1 | 7 | | |
| 2 | x | | |
| 2 | x | | |
| 2 | x | | |
| 19 | n | | |
| 19 | n | | |

| | | | |
|----|---|--|--|
| 19 | n | | |
| 33 | 2 | | |
| 48 | h | | |
| 13 | T | | |
| 33 | 2 | | |
| 36 | 9 | | |
| 4 | c | | |
| 46 | e | | |
| 46 | e | | |
| 46 | e | | |
| 61 | k | | |
| 26 | H | | |
| 47 | U | | |
| 47 | U | | |
| 33 | 2 | | |
| 56 | t | | |
| 0 | C | | |
| 0 | C | | |
| 2 | x | | |
| 9 | z | | |
| 11 | Z | | |
| 16 | d | | |
| 16 | d | | |
| 49 | I | | |
| 49 | I | | |
| 41 | X | | |
| 43 | Y | | |
| 46 | e | | |
| 46 | e | | |

Table 2

Merging the last two columns of two tables

- We are still missing sequence number 12, 15 , 21, and alphanumerics y, o , 5
- We can find some information about alphanumerics 'y' and 'o' from the third letter of the output
- Where 'y' lies between letter 'Z' and 'T' and 'o' lies between 'N' and 'd'
- Given the above information we can find that 'y' corresponds to sequence number 12 and 'o' corresponds to sequence number 15
- Then number '5' will correspond to sequence number 21

| | |
|----|---|
| 0 | C |
| 1 | 7 |
| 2 | x |
| 3 | i |
| 4 | c |
| 5 | P |
| 6 | M |
| 7 | G |
| 8 | v |
| 9 | z |
| 10 | A |
| 11 | Z |
| 13 | T |
| 14 | N |
| 16 | d |
| 17 | m |
| 18 | w |
| 19 | n |
| 20 | V |
| 22 | D |
| 23 | 3 |
| 24 | B |
| 25 | 6 |
| 26 | H |
| 27 | 0 |
| 28 | O |
| 29 | u |
| 30 | p |
| 31 | 8 |

| | |
|----|---|
| 32 | E |
| 33 | 2 |
| 34 | 1 |
| 35 | W |
| 36 | 9 |
| 37 | s |
| 38 | q |
| 39 | L |
| 40 | Q |
| 41 | X |
| 42 | 4 |
| 43 | Y |
| 44 | j |
| 45 | S |
| 46 | e |
| 47 | U |
| 48 | h |
| 49 | l |
| 50 | R |
| 51 | J |
| 52 | g |
| 53 | a |
| 54 | f |
| 55 | F |
| 56 | t |
| 57 | r |
| 58 | K |
| 59 | l |
| 60 | b |
| 61 | k |

3) Finding the third letter(leftmost letter)

- My approach for this was I took the first and last input 15840 and 79791 accordingly
- Calculated the difference between $79791 - 15840 = 63951$
- The output of the third letter of input 15840 is 'c' and 'V' to 79791, and each letter corresponded to sequence number 20 and 4
- Meaning that there are 17 sequence numbers between 4 and 20 (including both number)
- Thus $63951 / 17 = 3761.82$, and this number was close to $62 * 62 = 3844$
- Then I took the result of (input / 3844)

b) thus

- $f(30001) = GIF$
- $f(55555) = NOi$
- $f(77788) = VNQ$

c) The mapping function will not overflow as long as the following equation satisfies:

- $(\text{Input} / 3844) < 62$