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CS-130 - Discrete Math
Professor Addington
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Final Project - Option #2

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Program Explanation:

I hard-coded the assignment message as an array with 9 elements. Each element contains one line from the message to be encoded.

Test case: I print the entire message to verify that the original message was accurately entered into the program.

Then I iterate through each line of the message two chars at a time to check for double letters. I set up IF conditions to specifically check for the 8 double-letter combinations and have counter variables for each double letter that gets detected. If no double letters are found, I take the current char and pass it into a switch statement that assigns it an int value.

This assigns an int value 0-33 for each single and double letter and then this int is encoded with (x+6) % 34 and stored in a vector called "translatedMsg".

Test case: I count the amount of Chars in the original message and subtract the amount of double letters in my counter variables from it. I then compare this value to the number of ints stored in the vector "translatedMsg". These two values should be the same if the program works correctly.

Test case: I print out the contents of the "translatedMsg" vector so the user can visually check.

Test case: I decode the message by reversing the encoding process and print the message for the user to compare against the original message input to verify that the encoding process was done correctly.

Finally, I pass the vector into my ASCII printing function which prints 20 5x5 ASCII characters per line block.

<u>Favorite part of the program:</u>

The ASCII print function. It was challenging to implement conceptually because my ASCII letters take up 5 rows each to print in the terminal and I can only print one row at a time so I need to know which 20 letters will be assigned to each block and then access the portions of the array for each of those letters to print them all one row at a time until all 5 rows print. It ended up being easier to solve than I thought and was a matter of changing how I iterate through the array storing each ASCII value.

<u>Potential Program Improvements:</u>

- I could use File I/O which would allow me to input any message I wanted to be translated and then have it output as a file as well.
- Instead of ASCII, I could use SFML graphics library to print the images.

Program Output:

```
To: High Command
Subject: Battle status at San Bernardino Valley
I regret to inform you that the battle at San Bernardino Valley is not going well. The resistance forces at the San Berna
rdino Valley College have been using advanced tactics that our troops have not been trained to
counteract. We are facing a major disadvantage due to a lack of understanding of discrete structures and their use in war
fare.
Without additional reinforcements, I fear that our entire battalion will be defeated. We urgently require more troops who
 are trained in discrete structures and are equipped to handle the advanced tactics being used
by the resistance forces. With the right support, I am confident that we can turn the tide of this battle and emerge vict
orious.
I urge High Command to take immediate action and send us the reinforcements that we desperately need. The fate of this ba
ttle and the success of our mission depend on it.
Respectfully,
Clone Battalion Commander.

There are 791 letters in this message

Double letter counts:
Ae Ch Eo Kh Ng Oo Sh Th
0  0  0  0  5  2  0  20 = 27 double-letters

791 - 27 = 764 expected Aurebesh glyphs stored in the encoded vector
The vector has 764 glyphs stored
Congratulations! The expected vector size and actual vector sizes match!

Encoded message will have these 764 aurebesh glyphs:
example: '32' will call 32.png
32 25 16 17 15 16 8 25 22 22 6 23 10 30 0 7 18 11 8 32 7 6 32 32 21 11 30 32 6 32 0 30 6 32 30 6 23 7 11 29 23 6 29 10 17
 23 25 1 6 21 21 11 4 17 29 11 15 29 11 32 32 25 17 23 14 25 29 22 4 25 0 33 6 32 33 11 7 6 32 32 21 11 6 32 30 6 23 7 11
 29 23 6 29 10 17 23 25 1 6 21 21 11 4 17 30 23 25 32 15 25 17 24 2 11 21 21 33 11 29 11 30 17 30 32 6 23 8 11 14 25 29 8
 11 30 6 32 33 11 30 6 23 7 11 29 23 6 29 10 17 23 25 1 6 21 21 11 4 8 25 21 21 11 15 11 16 6 1 11 7 11 11 23 0 30 17 24
6 10 1 6 23 8 11 10 32 6 8 32 17 8 30 33 6 32 25 0 29 32 29 26 27 30 16 6 1 11 23 25 32 7 11 11 23 32 29 6 17 23 11 10 32
 25 8 25 0 23 32 11 29 6 8 32 2 11 6 29 11 14 6 8 17 24 6 22 6 18 25 29 10 17 30 6 10 1 6 23 32 6 15 11 10 0 11 32 25 6 2
1 6 8 19 25 14 0 23 10 11 29 30 32 6 23 10 17 24 25 14 10 17 30 8 29 11 32 11 30 32 29 0 8 32 0 29 11 30 6 23 10 33 11 17
 29 0 30 11 17 23 2 6 29 14 6 29 11 2 17 33 25 0 32 6 10 10 17 32 17 25 23 6 21 29 11 17 23 14 25 29 8 11 22 11 23 32 30
17 14 11 6 29 33 6 32 25 0 29 11 23 32 17 29 11 7 6 32 32 6 21 17 25 23 2 17 21 21 7 11 10 11 14 11 6 32 11 10 2 11 0 29
15 11 23 32 21 4 29 11 28 0 17 29 11 22 25 29 11 32 29 26 27 30 2 16 25 6 29 11 32 29 6 17 23 11 10 17 23 10 17 30 8 29 1
1 32 11 30 32 29 0 8 32 0 29 11 30 6 23 10 6 29 11 11 28 0 17 27 27 11 10 32 25 16 6 23 10 21 11 33 11 6 10 1 6 23 8 11 1
0 32 6 8 32 17 8 30 7 11 17 24 0 30 11 10 7 4 33 11 29 11 30 17 30 32 6 23 8 11 14 25 29 8 11 30 2 17 33 33 11 29 17 15 1
6 32 30 0 27 27 25 29 32 17 6 22 8 25 23 14 17 10 11 23 32 33 6 32 2 11 8 6 23 32 0 29 23 33 11 32 17 10 11 25 14 33 17 3
0 7 6 32 32 21 11 6 23 10 11 22 11 29 15 11 1 17 8 32 25 29 17 25 0 30 17 0 29 15 11 16 17 15 16 8 25 22 22 6 23 10 32 25
 32 6 19 11 17 22 22 11 10 17 6 32 11 6 8 32 17 25 23 6 23 10 11 23 10 0 30 17 23 11 17 17 23 14 25 29 8 11 22 11 23 32 30
 2 30 33 6 32 2 11 10 11 30 27 11 29 6 32 11 21 4 23 11 11 10 33 11 14 6 32 11 25 14 33 17 30 7 6 32 32 21 11 6 23 10 33 1
1 30 0 8 8 11 30 30 25 14 25 0 29 22 17 30 30 17 25 23 10 11 27 11 23 10 25 23 17 32 29 11 30 27 11 8 32 14 0 21 21 4 8 2
1 25 23 11 7 6 32 32 6 21 17 25 23 8 25 22 22 6 23 10 11 29
```

Decoding the encoded message to verify that the encoding was accurate:
tohighcommandsubjectbattlestatusatsanbernardinovalleyiregrettoinformyouthatthebattleatsanbernardinovalleyisnotgoingwellth
eresistanceforcesatthesanbernardinovalleycollegehavebeenusingadvancedtacticsthatourtroopshavenotbeentrainedtocounteractwe
arefacingamajordisadvantageduetoalackofunderstandingofdiscretestructuresandtheiruseinwarfarewithoutadditionalreinforcemen
tsifearthatourentirebattalionwillbedefeatedweurgentlyrequiremoretroopswhoaretrainedindiscretestructuresandareequippedtoha
ndletheadvancedtacticsbeingusedbytheresistanceforceswiththerightsupportiamconfidentthatwecanturnthetideofthisbattleandeme
rgevictoriousiurgehighcommandtotakeimmediateactionandsendusthereinforcementsthatwedesperatelyneedthefateofthisbattleandth
esuccessofourmissiondependonitrespectfullyclonebattalioncommander

Encoded Aurebesh message of 764 total characters with 20 ASCII characters per line

```
XX  X X XXX    XX  X X     X    XX   X   X XXX XXXX XXXXX XXXXX XXXXX XXXXX     X XX  XXX  XXXXX   X    X  XX X
X  X    X  X  X  X    X  X        XX X  XX X  X X X  X      XXXXX XXX    XX X X XX   XXX X
 X X      XX X   X X X X X  X     XXX      XX X     X   XXX  X   XXX X  X      X  X X X  X   XXX    XX
 X X     X  X    X X XX X   X  XX    X X     X   X   X X  X        X  X XXX      X  X   X   XX    XX
  X   X XX  XXXXX X  X  XX   XXXX XXXXX X XX  XX     XX    XXXXX X    XXXXX XXXXX X XX XXXXX X  X   X   XXXXX    X

  XXX  XXXXX XX  X XX X XX  X        XX  X XXXXX XX  XX XX       XXXXX XX  X      XXXXX XXXXX XXX    X   X  X
 X X   XX   XX   XX  X XX    XXXXX X   X X  XX  X XXX   XXXXX X  X X  X XXXXX X   X    X  XX  XX     XX
X  X   XXX XX  XXX X X X   X  X X X   XXX XX         X  X  XXX XX X   X  XXX   X  X  X  X  X  X      X
      X X XXX XX  X X  X   X  X X X X X   X X  X XXX X   X X X X  X XX XX         X      X
XXXXX XXXXX   X    X     XXX  X   XXXXX   X  XXXXX   X  X XX XXXXX XXXXX   X  XXXXX XXXXX X    XXXXX   X    X

XXXX XXXXX X   X XXXXX  XX X  XXXXX X XXX  XXX  XXXXX  XX X XX  X    XXXXX XX X X X X    X X  X  X  XX  X
  X X  X XX          X X    X     XX XX  XX XX  XX  X XX      X X X  XX XX       X  XX  XX   X
 X    XXX  X    XXX XXX  X       XX XXX    XXX X XX X  X    XXX  XXX  X     X X  X    X    X   XX
X  X  X  X       XXX X      XX  X XX  X X X X X  X    X    XXX X      X  X  X  XX   X    X XX
X     XXXXX  X   XXXXX X X X   X XX  XXX  XXXXX  XXX  XXX  X  X     X X  X      X   XX    X    X      X

XX  XX XXX  XX X XXXXX     XX X X X  X XXXX XXXXX X XXX  X  X     X XXXXX XX  X     X  X   XXX  XXXXX XX  X XX X
X  X     XX X   X    X     X    X X X X  X  X    X     X XXX     XXX X  X X X    X XXX    X X X  XX X X X  X
 XX    XX XX X  X    XXXX    XX  X X     XXX      XX     X X  XXX XX X  X X  X    X  X  X X  XXX XX  XX
 XX    X XXXX   XX X    X X  X      X    X  XXX     XX X XX    X X      X  X  X    X XXX  XX
  X X XX  X XX    X  X XX   X  XX   X    X XX X XX XXXXX XXXXX   X  XXXXX   X  XXXXX XXXXX   X    X

 XX X  X    XXXXX XX  X        XXXXX XXXXX XXX     X   X  X XXXXX XXXXX X  X XXXXX  XX  XXXXX X XXX  XXX  XXXXX XX X
X  X XX   X  XX   X XXXXX X  X   X  X XX  XX    XX   X  X  X XX        XX   X    XX  XX XX  XX X
X  X  X    XXX XX X  X XXX   X XXX  X  X X  X    X   X     XXX  X   XXX XXX  X    XX  XXX    XXX X
X X X  X X XXX X  XX XX X        X   X X X X  X  X    X         XXX X    X  X X XX  X  X  X
  XXX  X   XXXXX  X  XXXXX XXXXX X     XXXXX   X  X   X     XXXXX   X  XXXXX X X X    X XX  XXX  XXXXX   XXX

XX X  X   XXXXX XX      XXXXX X XXX XX  X    X X XXX XX X  XX     X   XX X XX X    X  X X  X  X
X  X XX      X X X XXXXX   X     XX X   X      XX X  X XXXXX XX   X  X X    XXX XX    XX  XX
X X X  X XXX  XXXX X X      XX X X X    XX XX X XXXXX   X  X XX  X X X  X   X      X     X
X X X  X   XXXX  X X       X XX XX    X XXXX XXXXX   X  X XXX X    X  X       X      X
  XXX  X  X    X X XXXXX X     X XX    X    XX X XX X XXX X     X  X   XXX  XXX XXXXX   X     X     X

    X X        XX  X XXXXX XXXXX   X   X     X X XXX X  X  X     X      XXXXX XX  X    X  X        XXXXX
XXXXX X  X XXXXX  X  XX X    X     XXX XX    X    X X X   XXX XX  XXXXX X  X X  X    XXX  XX   XXXXX X   X
X  XXXXX  X XX    XXX   X XXX    X    XXXX    XX X  XXX    X  X  X XXX XX X  X X   X  X  X    XXX
X  XXXXX  X XXX X XX    XX    X   X X  X    X  XX    X  X X XX  X XXX    X  X X  XX
XXXXX X X XXXXX   X  XXXXX X   XXXXX   X  X X XX   X  XXXXX   X  XXXXX XXXXX   X  XXXXX    X  XXXXX XXXXX

XXXXX XXX    X   X  X XXXXX XXXXX X   X XXXXX XX  XXXXX X XXX  XXX  XXXXX  XX X XX X    X  XXXXX   X   X XXX XX X
  X  X XX  XX     XX     X X  X X X     XX  X   XX XX  XX  XX  X XX    X   XXX     XX  X
  X X  X   X    X       X   XXX   X   XXX  XXX X   X  XX    X  X    XXX X X  X    X  XXX  XXX      XX X
X         X   X  X X  X  X       XXX X    X X X  XX X X X  X     X   X   X  XX      X X X
X    XXXXX  X    X   X X     XXXXX   X  XXXXX X X X    X XX  XXX  XXXXX    XXX  XXX   X  X    XXXXX X XX    XXX

 XX X   X     X     X    XX XXXXX XXX    X   XXX   X    X XXXXX X  XX     XX X  X XXXXX XXXXX  XXX  XXXXX
X  X XX      X  XX    X  X X X  XX    XX  XX    XX     X XXX   XXXXX X X X X  X       X  XX X
X  X X  X XX   X    X       XXX XXX    X X X  X    X    X     X XXXX XX  XXX XXX   XXX   XXX
 X X X    XX  X   X   X  XX  X  X         X    X    X   XXX   X  XXXXX XX  X       X  XX X
  XXX    X   XX    X    XXXXX XXXXX XXX     X   XXXXX   X    X    X XX XXXXX X X X X XXXXX XXXXX  XXX  XXXXX

XXXXX   X    X   XXXXX XX  X XXXXX     X  XX X XX X   X         X XXXXX XX  X X XXX X XX X  XX X XX X  X  X
   X   XXX XX         X X X  X  XXX X  X X X    XXX XXXXX   XXX X X X  X    X XXX    XX X  X XX   X
  X   XXX    X   XXX  X X  XXX XXX   XX X XXX XXX  X X X   X  XXX XX      XX        X   X X   X XXX
 X  XX   X          XXX X X XXX   XX X XXXXX X  X    X  XX XXX     X XXX     X   X X    X XXX
X    XXXXX   X   XXXXX   X  XXXXX XXXXX   X   X X XXXXX XXXXX XXXXX XXXXX   X  X XX X XX   X    X    X    XXX

XXXXX         XX XXXXX XXX    X   XXXXX X XXX XX X XXX    X    X   XXXXX XX  XX  X XXXXX XX  XXXXX   X    XXXXX
X  X XXXXX  X   X  XX X XX    X      XX X XX X XX      X  X X XXX X XX X X   X   X XX
XXX XXX X X     XXX XXX     X       XX XXX X XX        X     X  X   XXXXX X   X     X    XXX
X XX X  X  X         XXX X X X XX   X    X  XX        X     X     X   XX X  X XXXX X        X
XXXXX XXXXX XXXXX XXXXX XXX    X X     X XX   X    XXXXX   X    X X       X   X  XXXXX X X X     X    XXXXX
```

```
XX  X X       X   XXXXX   X          XXXXX   X   X  X XXXXX XX   X   X     XX X XXXXX XXXXX    X     X   XXXXX      X  X
X  X X X X  XX           XX   XXXXX X  X  XX      XX X  X XX  X XX   X  X   X     X  XX   XX             XXX  XX
 X X X X X   X      XXX      X   X  X XXX  X   X      X    XXX X X    X   X  X XXX     X    X    X    XXX  X X  X
 XX X X X  X           X  X  X X  X   X        X  X  X X X XX    X   X X X    X         X    X    X            X  X
   X        X  X   XXXXX   X   XXXXX XXXXX   X      X   XXXXX   X   X  X     XXX X    X       X    X   XXXXX XXXXX    X

   X XXXXX XX  X  X  X XXX     X     X X X       XXX  XXXXX XX  X XX  X XX  X   XXXXX XXXXX XXXXX      X  X
     XX  XX  X  X  XX      X     X   XXX X X  XXXXX XX X  XX  XX X XX  X XX  X  X    X           XXX  XX
 XXXX   XXX XX  X    X      XX  XXXX X X XXXXX  XX  X   XXX XX  XX X  X  X     XXX   X    XXX   X X  X
 X XX  X XX   X      X   X X    XXXXX  X      X  X XX  XX  X X  X   X  X X     X              X  X
X  X XXXXX   X      X  X XX  X  X XXXXX  X  X XXXXX XXXXX XXXXX   X     X     XXX   X   XXXXX X    XXXXX XXXXX    X

    X  XX   X    X   X            X XXX     X X XXX X  XX X   X XXXXX  XX         X X  X XXX XXXXX XXXXX
XXXXX XXX      XXX   XXX  XX   XXXXX XXXXX     X   X     XX   X  X X  X X  X XXXXX XXXXX X X    X    X
X  X           XXX   XXX      X X X X    X     XX XXXX    XX         X X     XXXX  XX  XXXX     XX  X    XXX
X  X XXX    XX X XX    X X X X    X   X X   X XXX    X  X     XXXX  XX  XXXX    X X
XXXXX X  XX XXXXX XXXXX    X    XXXXX XXXXX X XX   X    X XX  X XX   X   XX     X X XXXXX XXXXX X X XX  X      XXXXX

   X   XXXXX    X   XXXXX XXXXX X XXX XXXXX   XX XX XX  X  X         XXXXX   X    X  XX  X    XX XX  XX X  XX X
  XX   X X XX      X         X   X X X X  X  X XX  XX  XXXXX X  X XX    XXX X  X     X XXX   X  XX  X
  X  XXX X  X     X   XXX     XX  X  X X X XX   X     X  X X XXX X  X   XXX    XX  XXXX       X   X X
  X X  X X   X      X X   X X X X X  X X   XX   X X   X X XX  X X  X X    XX  X X XXX    X X X X
  X  XXXXX   X  X    XXXXX X XX  X     X X X   X    X   XXXXX XXXXX   X   XXXXX  X  X  X XX XX   XXX   XXX

XXXXX   X   XX X X XXX XXXXX    X    XXX  XXXXX XX  X XX  X XXXXX   XX X X X  X XXX XXXXX    X   X XXX XXXXX XXXXX XXXXX
   X   XXX X X    X   X  XX     XX X X  XX  XX XX  XX XX  X XX  XXX       X   X   XXX      XX  X XX  X XX  X
XXX   XXX  X  X  XX  X    X  X X  XXX XX  XX   XXX X XXXX    XX  X  XXX      XX X    X       XXX
X   XX  XX X  X X    X        X  X XXX XX X  X X XXXX   X X  X  XX   X X    X   X  X
X     XXXXX  XXX X XX  X     X   XXXXX XXXXX   X    X  XXXXX   XXX X X XX  X    XXXXX X XX  XX   XX    XXXXX

XXXXX XXXXX   X   X   X
   X        XX   X X
  X   XXX   X    X
 X           X    X
X     XXXXX   X    X
```

RUN SUCCESSFUL (total time: 129ms)

ASCII Documentation:

Printing 764 ascii images 5 x 5 characters each
20 ascii images per terminal line = 38 lines of 20
                                     1 lines of 4

| ```
X        X X
X X X
 
X X X
X        X X
``` | ```
X X X
X        X
  X X X
X        X
X X X
``` | ```
X
X      X   X
X      X   X
X      X   X
           X
``` |
| A 0 | B 1 | C 2 |
| ```
X X X
    X X
      X
      X
X X X  X X
``` | ```
X X X X X
          X
X X X
      X
X
``` | ```
X   X X X
X   X X
X X X  X
  X   X
  X    X
``` |
| Ch 3 | D 4 | E 5 |
| ```
X X X X X
X
      X X X
X
X X X X X
``` | ```
X X X
X     X
X          X
X
X X X X X
``` | ```
    X
X X X
X X X
X      X
X X X X X
``` |
| Ae 6 | Eo 7 | F 8 |
| ```
X      X X X
X          X
X          X
X      X
X X X
``` | ```
X X X X X
 
  X X X
 
X X X X X
``` | ```
   X
  X X
   X
   X
   X
``` |
| G 9 | H 10 | I 11 |

X
X X X X
X X   X
  X X
X X X
J 12
	X X X X X
	      X
	      X
	      X
	X X X X X
	K 13
		X
		   X
		X X X X
		X X
		X X
		Kh 14

X   X
   X
X   X
X   X
  X X
L 15
	X
	X
	X
	X
	X X X X
	M 16
		X X X X
		X X
		X X
		X X
		X X X X
		N 17

X X X X X X X X X X X X X **Ng 18**	X X X X X X X X X X **O 19**	X X X X X X X X X X X X **O 20**

X X   X
X
X
X
X X X
P 21
	X X X X X
	X X
	X
	X
	X X
	Q 22
		X X X X X
		X
		   X
		  X
		X
		R 23

S 24   Sh 25   T 26

Th 27   U 28   V 29

W 30   X 31   Y 32

Z 33