CS6102- Computational Thinking

Week -10

25 – Feb-2022

I. Ciphering a Sentence

1. Use the rules below to create ciphers.

Create two rules for mapping the alphabet.

Sample rules:

- The characters are divided into two groups: (1) characters for which the image of their uppercase form has an enclosed area (such as P or O) and (2) characters that do not have an enclosed area in in the image of their uppercase form (such as I or Z).
- Sort the two groups alphabetically, with group 1 first and then group 2.

Apply the rules.

Applying rule 1:
Group 1: {A, B, D, O, P, Q, R} Group 2: {C, E, F, G, H, I, J, K, L, M, N, S, T, U, V, W, X, Y, Z}

Applying rule 2:
A, B, D, O, P, Q, R, C, E, F, G, H, I, J, K, L, M, N, S, T, U, V, W, X, Y, Z

Place the letter sequence that resulted from Rule 2 in the second row of the following table beneath the number 1 to 26 (example completed below).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Alphabet Mapping #1.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
A	B	D	O	P	Q	R	C	E	F	G	H	I	J	K	L	M	N	S	T	U	V	W	X	Y	Z

Now, invent a third rule and apply it to the above mapping to come up with another one-to-one alphabet mapping table. A third rule could be to place the even-number-mapped letters in alphabetical order followed by the odd-number-mapped letters in alphabetical order. And let it be Alphabet Mapping #2.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Activity 2: Encode Sentences

Encode sentences using the mapping they developed in Activity 1.

a. Think of a simple message you would like to send to your partner.
b. Encode it three times: first use just Alphabet Mapping #1, then use just Alphabet Mapping #2, and then use both mappings from the previous activity.
c. If you have done a mapping on your own, use that for encoding.

For example, if the sentence is:
We drove to the gym.
Using the Alphabet Mapping #1, we find each letter of the sentence in the second row of the table created in Activity 1. We replace the letter with the corresponding number in the first row.
Please note that one must place letter breaks (the character "_") and separate each word by a blank space. In this example, the encoded sentence is:
23_9 3_7_4_22_9 20_4 20_12_9 11_25_17

2. Perform deciphering of following sentence.
   a. 10_6_20_23 22_18_23_23_14_19_18 25_14_23 25_17_20_10_10_18_9 20_9 4_20_16_6_18_17 (Using Alphabet mapping #2)
   b. 20_14_22 14_1_8_18 18_2 4_20_16_6_18_17 10_6_20_23.
3. Invent a fourth rule and apply it to the alphabet mapping#3 to come up with another one-to-one alphabet mapping table. A fourth rule could be placing the vowels at the first few positions followed by even-number-mapped letters in alphabetical order and then the odd-number-mapped letters in alphabetical order. And let it be Alphabet Mapping #3
   a. This message was written in cipher
4. Invent a fifth rule and apply it to the alphabet mapping#3 to come up with another one-to-one alphabet mapping table. A fourth rule could be placing the odd-number-mapped letters in alphabetical order at the first followed by even-number-mapped letters in alphabetical order. And let it be Alphabet Mapping #4
   a. The glasses were engraved with the Queen's cipher
5. Answer the following
   a. Imagine that another person gives you an encoded message and you do not know the mapping tables. How would you go about deciphering or decoding the sentences? What patterns would you look for to help you discover the one-to-one mapping?
   b. How would implement your cipher in a computer program? Write C code for the cipher.

II Data Analysis

1. Create the following details in a spreadsheet. And answer the following questions.

	A	B	C
1	**Name**	**Height**	**Shoe Size**
2	Sasha	63	6
3	Hector	68	9
4	Kayla	67	8
5	Adriana	65	7
6	Sean	64	7
7	Kay	61	3
8	Hillary	69	9
9	Thomas	68	9
10	Luis	64	8
11	Mayra	66	6
12	Michael	68	10
13	Tonya	64	8
14	Philip	65	8
15	Raymond	66	9
16	Jalen	70	10
17	Samantha	62	4

   a. Create a scatter plot and analyze data
   b. What piece of information can we get from the spreadsheet that we cannot from the graph?
   c. Describe any advantages of representing the data graphically.
   d. Describe any patterns in the trends between height and shoe size.
   e. If you want to find your best friend's height and shoe size, should you look in the raw data or in the graph? Where would you look to identify patterns in height and shoe size?
   f. Based on the scatter plot, list at least one exception to the trend of shoe size increasing as height increases.
   g. Write an algorithm that uses the data in the spreadsheet to create a scatter plot by hand.

2. Comparing Data Patterns

Breed	Lifespan (years)	Male Weight (lbs)
Afghan Hound	12	60
Airedale Terrier	11	60
American Stafford. Terrier	12	62
Basset Hound	13	42
Beagle	13	23
Bearded Collie	12	42
Bedlington Terrier	14	20
Bernese Mountain Dog	7	92
Border Collie	13	37
Border Terrier	13	14
Boxer	10	65
Bull Terrier	13	62
Bullmastiff	9	120
Cairn Terrier	13	16
Cav. King Charles Spaniel	11	14
Chihuahua	13	4
Chow Chow	14	57

Cocker Spaniel	13	23
Dachshund	12	15
Dalmatian	13	68
Doberman Pinscher	10	78
English Cocker Spaniel	12	33
English Setter	11	67
English Springer Spaniel	13	50
English Toy Spaniel	10	11
Flat-Coated Retriever	10	65
German Shepherd	10	80
German Shorthaired Pointer	12	63
Golden Retrievers	12	70
Gordon Setter	11	68
Great Dane	8	160
Greyhound	13	68
Irish Setter	12	70
Irish Wolfhound	6	110
Jack Russell Terrier	14	16
Labrador Retriever	13	72
Miniature Poodle	15	16
Norfolk Terrier	10	11
Old English Sheepdog	12	62
Pekingese	13	8
Pomeranian	15	5
Rhodesian Ridgeback	9	110
Rottweiler	10	115
Samoyed	11	55
Scottish Deerhound	10	100
Scottish Terrier	12	21
Shetland Sheepdog	13	18
Shiba Inu	14	25
Shih Tzu	13	13
Siberian Husky	14	47
Soft Coated Wheaten Terrier	13	40
Staffordshire Bull Terrier	14	35
Standard Poodle	12	40
Tibetan Terrier	14	24
Toy Poodle	14	7
Vizsla	12	53
Weimaraner	10	63
Welsh Springer Spaniel	12	40
West Highland White Terrier	13	18
Wire Fox Terrier	13	18

a. Create a scatter plot
b. Compare the trend in the graph in weight vs. lifespan to that in the graph of shoe size vs. height. Describe the difference between the two trends.
c. Do bigger breeds tend to live longer or shorter lives than smaller breeds?

III Data Compression

1. List 10 abbreviations that can be used to refer to something without having to say the entire word or phrase. Give some technical or scientific examples as well as those you might hear your friends say?

   Ex. Km for kilometer, Dept for departmet

2. **Activity 1**

   1. Pair students into groups of two.

   2. Have one student think of a word or phrase and write down one of the letters from that word, wait a second, then write another letter from that word, omitting some of the letters. All of the letters should be placed in the order of where they belong e.g. If I were thinking of "HELLO WORLD," I might write down "L," then later write down "LL," and eventually it might look like "H LLO W R D."

   3. Have the second student try to guess the word or phrase as quickly as possible.

   4. After the second student correctly guesses the word, students should switch roles.

   5. After a couple of turns, ask students to try and do the same activity using a shape or a visual scene like "student walking to school," where each student draws the shape or visual one line or curve at a time

   Q1: On average how much information (turns/steps) from the first person was necessary to guess Word Phrase Shape Visual

Word	Phrase	Shape	Visual

   Q2: Why do you think it required more information to guess a visual rather than a word?

   Q3: What could have made each of these easier to guess, so that it would require fewer steps to solve?

3. **Activity 3**

A hospital supervisor needs to create a weekly schedule for four nurses, subject

1. To the following condition
2. Eachdayisdividedintothree8-hourshifts.
3. On each day, all nurses are assigned to different shifts and one nurse has the day off.
4. Each nurse works five or six days a week.
5. No shift is staffed by more than two different nurses in a week.
6. If a nurse works shifts 2 or 3 on a given day, he must also work the same shift either the previous day or the following day.

Two ways to formulate the problem

- ✓ Assign nurses to shifts
- ✓ Assign shifts to nurses

Identify the errors and correct the following code

1.
```
#include<stdio.h>
void main()
{
       int x = 10;
       int y = 15;

       printf("%d", (x, y)) }
```

2.
```
void main()

{
      int n = 9, div = 0;
      div = n/0;

      printf("result = %d", div);
}
```

3.
```
#include<stdio.h>
 void Main()

{
      int a = 10;
      printf("%d", a);
}
```

4.
```
int main()

{
      int i = 0;
    for(i = 0; i < 3; i++);
{
  printf("loop ");
  continue;
}
 getchar();
 return 0;
}
```

5.
```
void main()

{
      int a, b, c;
       a + b = c;
}
```