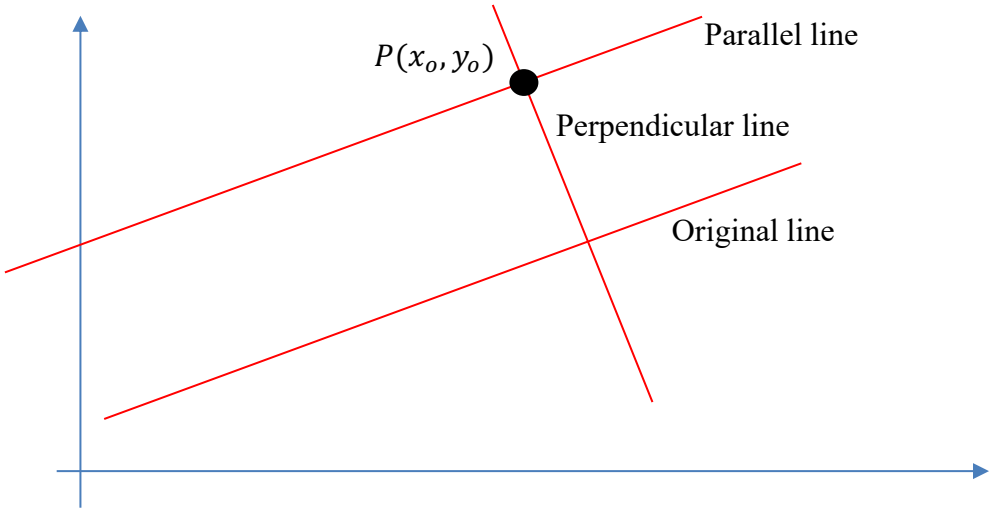
University of Glasgow | School of Computing Science

CSC1103 Laboratory/Tutorial 3/4: Data Type, Arithmetic Operation and Control structure

1. The equation of a straight line in $x - y$ plane is given

$$y = mx + c$$

where m is the slope and c the intercept. Given that a point P having the coordinates (x_0, y_o), find the equation of lines through this new point that are parallel and perpendicular respectively to the original line as shown in the figure below. This is a typical linear support vector machine (SVM) classification machine learning in one of its simpler form that is used to classify data in region for pattern classification.



Design the algorithm and pseudocode. Write the C program for the above. Assume that the inputs to the program consists of m, c, x_0, y_o. Your program should print the equation of the original line, the coordinates of the point P and the equation of the lines that are perpendicular and parallel to the original line.

2. Determine the arithmetic operation result for the following C program below. Assume float range from 1.2e-34 and 3.4e34. What are the respective value of the printed variables?

```
#include <stdio.h>

float a,b,c,d,e;

int main()
{
   a=1.0e+30;
   b=9.0e+38;
   c=a*b;
   d=a/b;
   e=1.1e-9+d;
   printf("c value is :%e\n",c);
   printf("d value is :%e\n",d);
   printf("e value is :%e\n",e);
}
```

inf

0e0

~1.1e-9

3. In old Roman days, Julia Caesar encryption known as Caesar Cipher is used to conceal the content in the message with his general during war time to prevent enemy get hold of the message. To pass an encrypted message from one person to another person, it is essential that both parties have the secret key so that sender encrypt with the secret key and receiver decrypt with the same secret key. The key is number of characters to shift the cipher alphabet

   In today world, Caesar Cipher is a mathematical encryption known as substitution cipher. It forms the basis for cryptography in today application such as Whatapps, Telegram, Wechat and web security https protocol. The working principle of Caser Cipher is shown below. Each letter of the 26 alphabets is given a number

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

   For example, with a secret key $k = 3$

Plaintext	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Cipher-text	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C

Plaintext : ATTACK THE NORTHEN SIDE OF THE VILLAGE
Ciphertext: DWWDFN WKH QRUWKHQ VLGH RI WKH YLOODJH

In modern computational implementation in system such as handphone, the mathematical description is

At encryption end:
The ciphertext C $C = (P + k) mod\ 26$
At decryption end
The plaintext P $P = (C - k) mod\ 26$

Design the above algorithm and pseudocode. Implement in C program with the above plaintext input. Ensure the encryption and decryption work and get back the same plaintext.