Homework 1

MSSC 6010- Computational Probability

Firstname Lastname

2023-08-26

Question 1

Find roots of $x^2 - 8x = 9$. Is $x \in \mathbb{N},\ \mathbb{Z},$ or $\mathbb{R}$?

We proceed by factoring,

$x^2 - x + 9x - 9 = 0$	Subtract 9 on both sides. Breaking the middle term.
$(x-1)(x+9) = 0$	Pulling out common $(x-1)$.
$x \in \{1, -9\}$	$f(x)g(x) = 0 \Rightarrow f(x) = 0 \vee g(x) = 0$.

Question 2

Figure 1 shows two cipher wheels. The left one is from Jeffrey Hoffstein, et al. [@hoffstein2008introduction] (pg. 3). Write an R program that uses it to encrypt: 'FOUR SCORE AND SEVEN YEARS AGO'.

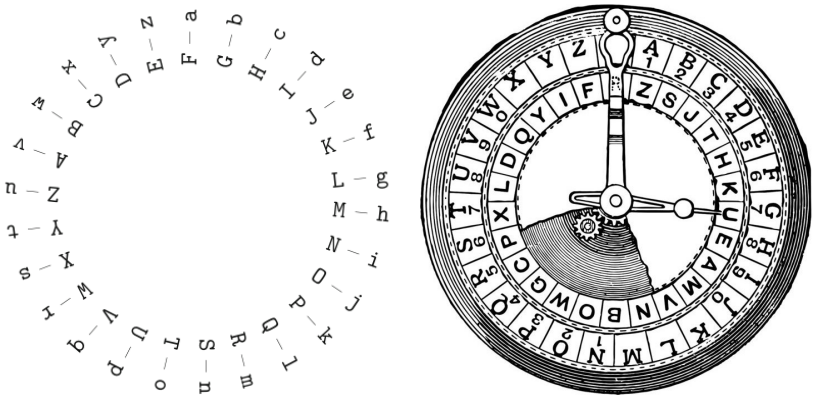


Figure 1: Cipher wheels.

The R program is given below and the encryption is given in Table 1.

```
encrypt <- function(plain) {
  cipher <- ""
  for (i in 1:nchar(plain)) {
    ch <- substr(plain, i, i)
    cipher <- ifelse(ch == " ", paste0(cipher, ch),
      paste0(cipher, toupper(letters[((utf8ToInt(ch) - 60) %% 26) + 1]))
    )
  }
  return(cipher)
}

print(encrypt("FOUR SCORE AND SEVEN YEARS AGO"))
```

Table 1: Caesar cipher

Plain Text	FOUR	SCORE	AND	SEVEN	YEARS	AGO
Cipher Text	KTZW	XHTWJ	FSI	XJAJS	DJFWX	FLT