

# COMP3355 Cyber Security

## Assignment 1

(Due on 23 Sep 2019, 23:59)

Q1. (15%) A sentence is encrypted using substitution cipher. Following is the encrypted sentence (spaces between words are suppressed):

ftqdg uezae gotft uzsme msdqm ffmxq zfiuf tagfs dqmfi uxxba iqd

Analyze the encryption to answer the following questions:

- (a) What is the substitution being used in the above cipher?
- (b) Recover the cipher text into plain text.

Q2. (15%) Suppose that the cipher text “ssthihttreffissaensigmtncuofoforbyueerscirrotycues” is encrypted using transposition cipher. The encryption key (permutation) is  $\pi = (6\ 4\ 1\ 2\ 3\ 5\ 8\ 7)$ .

- (a) What is the inverse permutation (decryption key)?
- (b) Decrypt the cipher text into plain text.

Q3. (40%) Referring to the lecture notes on DES, there are one Expansion Permutation (Table1), eight Substitution S-Boxes and one Permutation P-Box (Table 2) in the function  $f(K_i, R_i)$  for round  $i$  in DES encryption. Given that the input plain text is A7E2BC3FD4C896D2 and the encryption key is 1A5D6D895B4B66DB in hexadecimal representation. Implement round 1 encryption manually and list  $L_1$  and  $R_1$ . The initial permutation for input is shown in table 3.

Table 1: Expansion Permutation

32	01	02	03	04	05
04	05	06	07	08	09
08	09	10	11	12	13
12	13	14	15	16	17
16	17	18	19	20	21
20	21	22	23	24	25
24	25	26	27	28	29
28	29	30	31	32	01

Table 2: Permutation P-Box

16	07	20	21	29	12	28	17
01	15	23	26	05	18	31	10
02	08	24	14	32	27	03	09
19	13	30	06	22	11	04	25

Table 3: Input Permutation

58	50	42	34	26	18	10	2
60	52	44	36	28	20	12	4
62	54	46	38	30	22	14	6
64	56	48	40	32	24	16	8
57	49	41	33	25	17	9	1
59	51	43	35	27	19	11	3
61	53	45	37	29	21	13	5
63	55	47	39	31	23	15	7

**Q4. (30%)** An English prose quotation is encrypted with an unknown method. Below is the encrypted quotation (where spaces between words are suppressed).

fjwvs yfvbl hfwdu skevm wiodm bmiff wmhhu vzsxj iqjvs zfvhv  
bvvjp hepqe dfrjs swtif zolmp hzzhz xiye wliem wrhww ubufi  
ylubh rbryt jdths revbr rwwjl hkcvi wyofd jimuw zcfwi csjka  
xiuvz osren kvdsg jzltz svucf lzsvm swyfg yhbdj ssrbh gkvwt  
bwlww umtfd erkjp lxdhz vfybv ojwba rrikx suoza kidou vrsrj  
hdlum vbfvv oleun kvssw uuvzo kyngl ktgpm izzby mumdt qwwtc  
rehgx iywis sxzii raaxz uquqg sqyur hasou xjhje mcdzg sqfge  
vfgju bhtce qphzv odxii ieolm phvzb oljwk kvwgp gpfbo ibfwy  
vweem rwugz flqds fxnyh kwfkt jufja hfnkv asmoz riiej plffc  
hisuw zcfew mwiod mbbdj sfisa hkwue mfbgi jwvyg kvwgb ovvcx  
monhi bsxji qrzlv bxhcz tisuo zgsxj iqrik xsuoz odien kvtdg  
nuwzc fsgnk vqsms hvxfg yququ okmbj dtwxm dyffb gqjwf fchis  
uwzcf mucvr awqcy uftll fiuxo fntuw zcfjp lhtcf snctf cgtfl  
dkwgr bhgus nimis dsfxb hgkvw aplou hjeey riusr jtdkw grubh  
issvf mhmsj emgda cjjff dksje mzuvs lvbxh rujif ghehk evmwi  
odmbb djdmv tohua gwulh tsfxm swyss ytnur zaevh lkswv uuvvg  
xvfyw iovib auvse ionde ruppm hisus oipzq jimuw zcfwx cwybw  
aaydc ofhbz rlbvm oapva tiswr lblvz iikvw yocwv rfeuc regsy  
tnurz aebfv fasmu ndzbx eocqk sjrbn lfbsp bcggf gksup lbvis  
qkzqz wpghj wpxzw rlbvz jyvis uijph rgkmt ndeqw xiyel ryiu  
ufjah fmrms jxxid erslb fiswd pjicw cjhfp hcchq fhwrq kmtd  
eqwet usvfz iondx sgjhx skvaw diqkf afvnl fbawm yvjhz eonkr  
hgjub hlbem mfheb aynxh msdsq ghehy sbfv

Analyze the encryption to answer the following questions:

- (a) What type of cipher is it? (Monoalphabetic / Polyalphabetic)
- (b) Give the permutation(s) (if any) or the substitution(s) used in the cipher.
- (c) Recover the cipher text into plain text.

**In your answers, you should show the detailed steps of your solution instead of listing the plain text only.**