# COSC2539: Security in Computing and IT

# Assignment 1

# Part 2 Cryptography Semester B, 2017

REPORT

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### Assignment Objective

The aim of this assignment is to comprehend the abstraction of cryptography by using programing language to write algorithms in order to decrypt several cipher-texts base on provided keys or encrypting algorithms.

### Technique

Java has been used to write decoding algorithm, due to its object-oriented characteristic.

### Strategy For Decryption

Caesar

For this encrypting algorithm, in unknown-key case, each character in the cipher text has been taken to be transformed into equivalent characters in 49 shifted alphabets, then these 49 results will be processed by scoring algorithm to sort out top of three results based on looking up the english dictionary. (/src/decryption/Caesar.java)

Columnar Transposition

Firstly, based on the cipher-text’s length, the algorithm for calculating common divisors had been coded. After having the common divisors, another algorithm will continue to process the cipher text message to construct the plan text messages. Similarly to Caesar, the scoring algorithm will find out the top three results. (/src/decryption/Transposition.java)

Caesar & Columnar Transposition

The algorithm for this case is a collaboration of previous decryptions, after having the results from columnar transposition’s decoding algorithm, these results will be continually decrypt by caesar's code. (/src/decryption/Transposition.java)

Random Substitution

The strategy for encrypting random substitution is far more complicated than the previous one. Consequently, the algorithm have not automatically done the decryption, it must be assisted by human intelligence. First of all, there is a method which is named Monogram Analysis, will count the frequencies of all characters in the cipher-text, and it will create an Frequency Table file. Second of all, the Space Analysis algorithm will transform each character into white space, split them into cases (each character is equivalent with one case), and count the length of longest word in each case. The case which has the lowest longest-word will be the most possible case. In order to continue the process, the Frequency Table file must be updated by adding which letter will be transform to white space according to the result from Space Analysis. Furthermore, The Get One Letter Word From Cipher will return some one-letter-word words, and then assume these will match with character “A” or “I”, due to a reason is that character “A” and character “I” are the most common one-letter words in English, and especially in academic writing, “A” is more common than “I”. Based on character which is equivalent with “A”, other two-letter words which are having “A” and missing one character, must be guess according to two-letter-word dictionary. After updating characters on previous steps, the rest of characters must be manually guessed to find out final plan text.

Vernam

The program will continually take parts of provided text as keys which have length that equal to the length of cipher-text, then do the calculations between each character of cipher-text and key to produce multiple results. The results will also be sorted by scoring method.

Automated Random Substitution (Beta)

The algorithm for decrypting automatically have been coded partially, but it is still not handled in an accurate way because multi threading process in Java has not used maturely.

### Results

Question 1:

Key: 39

Plan text:

LIVING IN VIETNAM

LOCATED IN SOUTH EAST ASIA, VIETNAM OCCUPIES THE SOUTH OF THE INDOCHINA PENINSULA WITH THE SHAPE OF AN ELONGATED 'S'. A TROPICAL COUNTRY, VIETNAM HAS DIVERSE SCENERY: FROM SOARING MOUNTAINS TO WHITE SANDY BEACHES, FROM TROPICAL FORESTS TO MYSTERIOUS CAVES.

VIETNAM IS ALSO WHERE YOU CAN FIND A FEAST OF HISTORY AND CULTURE. VIETNAMESE CULTURE IS DISTINCT: A FUSION OF CHINESE, JAPANESE, AMERICAN AND FRENCH CULTURES.

THE COUNTRY IS DIVIDED INTO THREE AREAS: NORTH VIETNAM, CENTRAL VIETNAM AND SOUTH VIETNAM. WHILE THE NORTH IS KNOWN FOR ITS OLD AND HISTORIC CAPITAL, CENTRAL VIETNAM IS FAMOUS FOR ITS SPECTACULAR BEACHES AND LAGOONS. COMING TO THE SOUTH, YOU WILL ENCOUNTER DYNAMIC HO CHI MINH CITY'S MODERN LIFE. LIVING AND STUDYING IN VIETNAM WILL YOU AN OPPORTUNITY TO EXPLORE A UNIQUE, HISTORIC, EXOTIC, YET RAPIDLY DEVELOPING COUNTRY.

Question 2:

Key: 18

Plan text:

HEALTH CARE SERVICES AND SAFETY CONCERN

MOVING AWAY FROM HOME, THE ALTERATIONS IN CLIMATE, IN LIVING ENVIRONMENT ARE SIGNIFICANT FACTORS AFFECTING ONE'S HEALTH CONDITION. IT IS IMPORTANT FOR INTERNATIONAL STUDENTS TO TAKE CARE OF THEIR HEALTH. IT IS RECOMMENDED THAT BEFORE TRAVELLING TO VIETNAM, YOU SHOULD PURCHASE PRIVATE HEALTH INSURANCE TO HELP COVER THE COST OF TREATMENT AT PRIVATE HEALTHCARE ESTABLISHMENTS.

AMONG THE WIDE RANGE OF HOSPITALS AND DIFFERENT STANDARDS OF HEALTHCARE, PRIVATE HOSPITALS ARE GENERALLY ON PAR WITH THOSE IN THE WESTERN COUNTRIES AND ACCEPT INTERNATIONAL HEALTH INSURANCE. THE MAJORITY OF DOCTORS ARE FROM THE US, KOREA, JAPAN AND FRANCE, AS WELL AS OVERSEAS-TRAINED VIETNAMESE DOCTORS.

AT RMIT VIETNAM, THE HEALTH AND SAFETY OF THE STUDENTS IS A TOP PRIORITY. WE HAVE 24-HOUR SECURITY, HEALTH CENTRES AND COUNSELLING SERVICES ON CAMPUS.

Question 3:

Algorithm:

Columnar Transposition

Key: 20

Plan text:

'RMIT UNIVERSITY VIETNAM PROVIDES PROGRAM SPECIFIC INTERNSHIPS. DURING THE INTERNSHIP STUDENTS ARE ENROLLED INTO SPECIFIC INDUSTRY-BASED COURSES THAT INTEGRATE THE STUDENT'S THEORETICAL KNOWLEDGE WITH WORKPLACE EXPERIENCE. STUDENTS TAKE ON A RANGE OF FINITE PROJECTS THAT EMPLOYERS CAN HELP IDENTIFY, WHILE RMIT UNIVERSITY VIETNAM PROVIDES CLOSE ACADEMIC SUPERVISION. THIS GIVES A RICHER EDUCATIONAL EXPERIENCE AND IMPORTANT SKILLS MAKING STUDENTS MORE WORK-READY UPON GRADUATION.

THE INTERNSHIPS HAVE PROVEN BENEFICIAL FOR A PLETHORA OF COMPANIES WHO HAVE BEEN ABLE TO "TRIAL RUN" RMIT UNIVERSITY VIETNAM STUDENTS FOR POSSIBLE OFFICIAL EMPLOYMENT LATER. ‘

Question 4:

Key: ‘D’ -> ‘ ‘ (white space), ‘L’ -> ‘E’, ‘P’ -> ‘O’, ’N’ -> ’N’, ‘1’ -> ’T’, ‘K’ -> ‘I’, ‘(‘ -> ‘A’, ‘.’ -> ‘R’, ‘:’ -> ’S’, ‘J’ -> ‘L’, ‘,’ -> ‘U’, ‘8’ - > ‘Y’, ‘R’ -> ‘G’, ‘I’ -> ‘D’, ‘Y’ -> ‘H’, ’T’ -> ‘P’, ‘O’ -> ‘M’, ‘ ‘ (white space) -> ‘C’, ‘?’ -> ‘F’, ’ ’ (return/enter/next-line) -> ‘V’, ‘3’ -> ‘W’, ‘X’ -> ‘.’, ‘Q’ -> ‘B’, ‘2’ -> ‘,’, ‘G’ -> ‘K’, ‘-‘ -> ’ ’ (return/enter/next-line), ‘$’ -> ‘’’ (single quote), ’S’ > ‘-‘, ‘M’ -> ‘X’, ‘!’ -> ‘J’.

Plan text:

RMIT VIETNAM IS A GLOBAL UNIVERSITY OF TECHNOLOGY AND DESIGN...

TECHNOLOGY NOW UNDERPINS SO MANY ASPECTS OF MODERN LIFE. WHETHER YOU ARE READING THE NEWS FROM YOUR LAPTOP, BUYING MOVIE TICKETS ON YOUR SMARTPHONE ON THE WAY TO THE CINEMA, OR USING A RECIPE APP ON YOUR TABLET WHILE YOU COOK - TECHNOLOGY HAS BECOME INTEGRATED WITH OUR DAILY EXISTENCE.

TAKING A DEGREE IN A AN IT-RELATED FIELD MEANS LEARNING SKILLS THAT HELP TO SOLVE PEOPLE'S PROBLEMS IN CREATIVE, INNOVATIVE WAYS, USING TECHNOLOGY TO TRANSFORM PEOPLE'S WORLDS. IF YOU'RE INTERESTED IN BEING A LEADER IN A CUTTING EDGE INDUSTRY, YOU MAY HAVE JUST FOUND YOUR FUTURE.

Question 5

Key: A GLOBAL UNIVERSITY OF TECHNOLOGY AND DESIGN...

TECHNOLOGY NOW UNDERPINS SO MANY ASPECTS OF MODERN LIFE. WHETHER YOU ARE READING THE NEWS FROM YOUR LAPTOP, BUYING MOVIE TICKETS ON YOUR SMARTPHONE ON THE WAY TO THE CINEMA, OR USING A RECIPE APP ON YOUR TABLET WHILE YOU COOK - TECHNOLOGY HAS BECOME I

Plan text:

WHAT IS INFORMATION TECHNOLOGY?

INFORMATION TECHNOLOGY IS ABOUT FINDING THE BEST SOLUTIONS TO MANAGE INFORMATION USING COMPUTERS AND SOFTWARE. IT PROFESSIONALS USE CUTTING EDGE TECHNOLOGIES TO STORE, PROTECT, PROCESS, TRANSFER AND RETRIEVE INFORMATION SO THAT ORGANISATIONS CAN RUN MORE EFFICIENTLY.

Question 6

Key: 40

Plan text:

THE BACHELOR OF INFORMATION TECHNOLOGY PROGRAM IS ACCREDITED AT THE PROFESSIONAL LEVEL BY THE AUSTRALIAN COMPUTER SOCIETY (ACS), AN ORGANISATION THAT ACCREDITS INFORMATION AND COMMUNICATION TECHNOLOGY RELATED PROGRAMS IN AUSTRALIA.QQQQQQQQQ

Question 7

Key: ‘F’ -> ’ ’ (white space), ’T’ -> ‘E’, ‘$’ -> ‘I’, ‘H’ -> ’T’, ‘J’ -> ‘A’, ‘2’ -> ’N’, ‘A’ -> ‘R’, ‘“‘ (double quote) -> ‘O’, ‘U’ -> ’S’, ‘0’ -> ‘L’, ‘Q’ -> ‘M’, ‘4’ -> ‘D’, ‘7’ -> ‘C’, ‘L’ -> ‘U’, ‘-‘ -> ‘G’, ‘1’ -> ‘V’, ‘K’ -> ‘H’, ‘Z’ -> ‘F’, ‘9’ -> ‘P’, ‘Y’ -> ‘Y’, ‘D’ -> ‘B’, ‘ ‘ (white space) -> ‘.’, ‘B’ -> ‘W’, ’S’ -> ‘,’, ’N’ -> ’ ’ (return/enter/next-line), ‘P’ -> ‘Q’, ‘8’ > ‘-‘, ‘C’ -> ‘K’, ‘?’ -> ‘X’, ‘6’ -> ‘’’ (single quote)/

Plan text:

TEACHING AND LEARNING AT RMIT VIETNAM

RMIT VIETNAM IS COMMITTED TO PROVIDING QUALITY EDUCATION. THE DEGREE YOU WILL RECEIVE AFTER SUCCESSFUL COMPLETION OF YOUR STUDIES IN VIETNAM IS A GLOBAL RMIT UNIVERSITY DEGREE. THE LEARNING OUTCOMES AND ASSESSMENTS FOR COURSES TAUGHT IN VIETNAM ARE EQUIVALENT TO THOSE DELIVERED AT RMIT MELBOURNE. ACADEMIC STAFF EMPLOYED AT RMIT INTERNATIONAL UNIVERSITY VIETNAM WORK IN COLLABORATION WITH ACADEMIC STAFF FROM RMIT UNIVERSITY MELBOURNE TO CUSTOMISE THE MATERIALS THAT ARE PREPARED IN MELBOURNE FOR DELIVERY IN VIETNAM, AND TO FACILITATE THE TEACHING AND LEARNING PROCESSES AT RMIT VIETNAM. THE ACADEMIC'S ROLE AT RMIT VIETNAM IS FOCUSED ON ADDING VALUE TO THE TEACHING AND LEARNING PROCESS THROUGH CREATIVE FACILITATED LEARNING. THE TEACHING AND LEARNING MODEL AT RMIT VIETNAM IS BASED ON INTERNATIONAL BEST PRACTICE AND INCLUDES CLASSROOM LEARNING EXPERIENCES, FACILITATED ON-LINE AND SELF-DIRECTED LEARNING BY STUDENTS, AND PEER LEARNING.