**TEMASEK POLYTECHNIC**

**SCHOOL OF INFORMATICS & IT**

**AY2017/2018 OCTOBER SEMESTER (LEVEL 1)**

**DATA STRUCTURE AND ALGORITHM (CIT1C14**)

**PROJECT 1 (80%)**

This is an **individual** assignment. Your submission must not contain any plagiarized materials and source code.

**Objectives**

This assignment requires students to put into practice the various topics covered so far in data structures and algorithms.

**PART A (40%)**

Start: Week 2 **Due: 7 Dec 2017, 9 am**

1. **Search Algorithms (12%)**
   1. Consider the following array:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 20 | 151 | 37 | 13 | 220 | 181 | 81 | 160 | 91 | 243 | 60 |

DONE Note : A, B, C, D and E refer to one of the last five digits of your student’s admin number. For example, the last five numerical digits are 01713, so A = 0, B = 1, C = 7, D = 1 and E = 3.

Show with the aid of a series of diagrams to search for the number **165** using Binary Search algorithm. Calculation of middle for each iteration at each step should be shown.

1. Draw a graph for sequential search and binary search, with y-axis being the time taken to complete the search and x-axis being the size of the data. Based on what you have learnt in Statistic and analytic , complete the followings.

i. Discuss the relationship of each of the graphs.

1. Analyse the efficiency for each of the graphs.
2. Can we do extrapolation beyond the range of the data for the graphs? State your reason(s).
3. State one advantage of sequential search over binary search.
4. **Funny Coin Jukebox (8%)**

There is a funny coin jukebox that can play at most 5 songs as long as the user insert a dollar coin in it. Write a program (in Python) that will stimulate the jukebox playing songs using a stack data structure.

The program will have a stack data structure with 5 songs pushed to it as below.

|  |  |
| --- | --- |
| **No.** | **Song Title** |
| 1 | One call away |
| 2 | Firework |
| 3 | Faded |
| 4 | I believe I can fly |
| 5 | Just the way you are |

It will then generate and display a random number, *x* between 1 and 10, inclusive.

* If *x* is between 1 and 8, inclusive, a song from the stack will be played.
* If *x* is 9 or 10, the program will push “exit” onto a stack data structure and exit the loop of 5.

Upon exiting the loop, display all songs played on the stack with pop method. However, do not display the “exit” item on the stack.

Use logic compound statement learnt in Logic and mathematics to construct the condition for playing song(s). Use sequence and recursion learnt in Logic and mathematics to construct an appropriate loop that allows the jukebox to play a maximum number of songs, 5 and the minimum number of songs, 0.

Sample Output A:

Random Number:

8

Random Number:

3

Random Number:

2

Random Number:

10

Have a nice day

We have played the following song(s):

#5 - Just the way you are

#4 - I believe I can fly

#3 – Faded

Sample Output B:

Random Number:

9

Have a nice day

1. **Lucky Draw (9%)**

Pong Pong Shopping Mall is having their weekly lucky draw contest. 5 shoppers are chosen from a pool of lucky draw forms at the information counter. These shoppers will form a queue. The shopping mall host will call the shoppers based on the queue and ask them a question. These shoppers will be given a $100 voucher if they have answered the question correctly. If the shopper did not pick up the call, he/she will rejoin the queue for a second chance.

Your program will do the following:

* 1. Add 5 shoppers’ name to a queue on a first-come-first-served basis.
  2. Display the names from the queue on a first-come-first-served basis.
  3. Start calling the shoppers by dequeuing a shopper and generate a random number, *call* to be between value 1 and 2. If *call* is 1, the shopper picked up the call. Otherwise, the shopper did not pick up the call.
  4. Upon picking up the call, a random number, *answer* to be between value 1 and 2 is generated to simulate the answering of the question. If *answer* is 1, the shopper answered the question correctly. Otherwise, the shopper did not answer the question correctly.
  5. However, if the shopper did not pick up the call, he/she will need to rejoin the queue.
  6. After calling all 5 shoppers, display the following statistic:
     + all shoppers in the queue with each of their name displayed correctly
     + number of shoppers who did not pick up the call
     + percentage of shoppers who picked up the call and answered correctly
     + percentage of shoppers who picked up the call and did not answer correctly

This question requires logic, and sequence and recursion learnt in Logic and mathematic and probability in Statistic and analytic.

Sample Output:

Welcome to Pong Pong Shopping Mall Weekly Lucky Draw!

Shopper #1: Adam

Shopper #2: Ben

Shopper #3: Cassie

Shopper #4: Deborah

Shopper #5: Elvin

Lucky Draw Contest starts ...

Calling Adam...

Answer the call: Yes

Answer the question correctly: No

Have a nice day

Calling Ben...

Answer the call: Yes

Answer the question correctly: No

Have a nice day

Calling Cassie...

Answer the call: Yes

Answer the question correctly: Yes

Congratulation!

Calling Deborah...

Answer the call: Yes

Answer the question correctly: No

Have a nice day

Calling Elvin...

Answer the call: No

Call later

Still in the queue =

Elvin

Number of shoppers who did not pick up the call = 1

Percentage of shoppers who picked up the call and answered correctly = 20.0

Percentage of shoppers who picked up the call and did not answer correctly = 60.0

**\*\*\*\*\* End of Project 1 Part A \*\*\*\*\***

**Part A Status Report (5%)**

The status report must be typed-written using Microsoft Word with 1 inch margin all round, portrait, Times New Roman font, size 12, single line spacing. Proper English MUST be used for the writing of report.

Write a short summary of the final state of your assignment in a file called Status\_<YourName>\_<AdminNumber>.doc.

E.g. *Status\_LimChuKang\_1709115J.doc.*

Your report should include the following:

* The assumptions made.
* Any question you did not complete with reasons for not completing the questions.
* Any problems you encountered while doing the assignment and how you go about resolving them.
* Any improvements / additional features attempted.

# Marking Scheme for assignment submission

**Total: 40%**

|  |  |
| --- | --- |
| **Part A** | **%** |
| 1. Search Algorithms | 12 |
| 2. Funny Coin Jukebox | 8 |
| 3. Lucky Draw | 9 |
| Programming Style (Documentation/Comments) | 2 |
| Additional features/ Efficient code | 4 |
| Report | 5 |
| Total | 40 |

# Deliverables

There are a total of **THREE** items which you need to submit as follows:

1. An individual, typewritten report satisfying the following criteria:
   1. Status Report with its cover page as shown in Appendix 1, which can be found at the end of this assignment specification.
   2. All answers are accompanied by detailed computations and workings (e.g. tables, diagrams, etc.). Include answers for Q1.
2. Program/Coding files
3. A signed declaration of work originality bearing your signature in hardcopy

**Method of Submission**

The report and the program/coding files must be compressed into a .zip file and labeled as [your\_matric\_no].zip. (E.g. 1701234A.zip). Please do not use other file compression methods (e.g. rar).

This zip file must be submitted electronically to TP-LMS before the deadline.

### Penalty

You will be penalised for the following:

* syntax, link and runtime errors (so test early and test often!)
* lack of comments and missing header comments
* poor programming styles (including indentation, variable naming etc.)
* poorly written/formatted status report
* late submission.

###### **Penalty for Late Submission Without Valid Reasons**

late and <1 day : 10% deduction from absolute mark given for the component

late>=1 and <2 days : 20% deduction from absolute mark for the component

late>=2 days : No marks awarded

Note that “day” includes **non-working days** (Sat, Sun and public holidays).

General MC/LOA is NOT considered as valid reason for extended assignment submission.

**\*\*\*\*\* End of Project 1 \*\*\*\*\***

**Appendix 1: Report Template**

# Temasek Polytechnic

## School of Informatics & IT

### Diploma in [Your Diploma Name]

### AY 2017/2018 October Semester

Data Structures and Algorithms (DSAG)

CIT1C14

Project 1 Part A Report

|  |  |
| --- | --- |
| Name (As in Class Register) |  |
| Matric Number |  |
| Tutorial/Lab Group |  |

# Introduction

This section should include:

1. Can your code be executed without error? If not, state the class(es) that failed to compile.
2. What grade do you think you should deserve? State you reason to explain.
3. What you could have done to achieve better grade?

# Assumptions

This section should include your assumptions and reason why you need such assumptions.

# Additional features

This section should include:

1. What are the additional features?
2. Are they useful?
3. How to test them?

# Process and steps to complete the project

This section should include:

1. How did you start the project? When? Did you make any plan?
2. How did you do? State steps or processes went through.
3. How to improve in the future? What are the steps and processes that you want to know more?

# Include the solutions for Q1

This section should include:

1. A series of diagrams to do searching using Binary Search algorithm.
2. A graph for Sequential Search and a graph for Binary Search.
3. Answers to b(i) to b(iv)

# Problem faced and solution

This section should include:

1. State any problem you have encountered
2. Explain how you managed to solve them.
3. What did you learn from these problems?

# References

This section should include:

1. State clearly if you use any references to complete this assignment: Book? Website? Note? Tutorials?
2. State clearly if you receive help from any of your friend or classmate (who are they? What kind of help?)
3. State clearly which lecturer/tutor did you come for help? Are they helpful?

# Appendix 2

# Declaration of Work Originality

**Diploma in Business Intelligence & Analytics**

**Diploma in Big Data Management & Governance**

**Diploma in Financial Business Informatics**

**Diploma in Mobile & Network Services**

**Diploma in Information Technology**

**Diploma in Digital Forensics**

**Diploma in Cyber & Digital Security**

**Diploma in Game Design & Development**

**Data Structures and Algorithms (CIT1C14)**

**AY2017/2018 Oct Semester**

**Practical Class**: P0X

**Submitted by**:

<Matric number of student > <Full name of student>

**Date:** <signing date in dd /mm/yyyy format>

**“By submitting this work, I am / we are declaring that I am / we are the originator(s) of this work and that all other original sources used in this work has been appropriately acknowledged.**

**I / We understand that plagiarism is the act of taking and using the whole or any part of another person’s work and presenting it as my/ our own without proper acknowledgement.**

**I / We also understand that plagiarism is an academic offence and that disciplinary action will be taken for plagiarism.”**

**Name and Signature of student: ……………………………………**