WelTec
Te Whare Wānanga o te Awakairangi

SD 6502 PROGRAMMING II

Assignment 1

School of Information Technology
Bachelor of Information Technology 2020

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Assignment 1 **Due Date: Friday 24th April 2020, 11:59 pm**

Topics (LOs):

1. **Implement software designs in an object-oriented programming language**
2. **Analyse relationship between algorithms and programming, and determine their efficiency**

Weighting = 25% of final mark.

Total Marks = 125.

Part I

To develop a simple card game – Blackjack or otherwise known as '21'

"The Blackjack game works as follows. Players are dealt cards with point values. Each player tries to reach a total of 21 (called Blackjack) without exceeding that amount. Numbered cards count as their face value. An ace count as either one or 11 (whichever is best for the player), and any jack, queen or king counts as 10.

The computer is the house and it competes against one to seven players. At the beginning of the round, all participants (including the house) are dealt two cards. The players can see all the cards, except one of the house's cards. But the house must reveal directly the second card if it makes its hand a blackjack. Next, each player gets the chance to take one additional card at a time for as long as the player likes (called hit). If the player's cards exceed 21, the player loses (busts). When all players stop taking additional cards, the house reveals its hidden card and takes automatically additional cards as long as its total is 16 or less. If the house busts, all players who have not busted before win. Otherwise, the player wins if its total is greater than the house's". If totals are the same, it is a tie (push) [4].

More on this game visit Wikipedia page https://en.wikipedia.org/wiki/Blackjack

Task 1: **[20 Marks]**

For the textual description of the game given above:

a. Identify classes (5-6 or more), methods (messages) and attributes. Show all the steps involved. Give reason for your choices of class and methods. [10 Marks]
b. List CRC cards for each classes you identified. [5 Marks]
c. Give Class diagram [5 Marks]

Task 2 **[20 Marks]**

Write a program for the game in Task 1(Blackjack).

In your solution,

1. You may encode cards as follows (using c# *enums*)

   Encoding of Suits:

Suit	Spade	Heart	Diamond	Club
Encoding	S	H	D	C

   Encoding of ranks:

Rank	A	2	3	4	5	6	7	8	9	10	J	Q	K
Encoding	1 or 11	2	3	4	5	6	7	8	9	10	10	10	10

2. You may use game play logic (algorithm)as given below

   a. Deal players and the house two cards
   b. Hide the house's first card if not Blackjack
   c. Display players' and house's hands
   d. Deal additional cards to players
   e. Reveal house's first card
   f. Deal additional cards to house
      - ✓ If house is busted
        Everyone who is not busted wins
      - ✓ Else
        For each player
        -If player is not busted
        If player's hand > house's hand

Player wins
Else if
player's hand < house's hand
Player loses
Else
Tie game
-Else
Player loses

- ✓ Move everyone's cards back into deck

3. You may write and use methods "flip a card", "add a card to a hand", "clear a hand", "get the value of a hand", "shuffle deck", "deal cards", etc in the appropriate classes you have identified.
4. You **must** use the concept of the inheritance, polymorphism, and write polymorphic code (i.e use of overriding, making base class object behave like child class object …wherever appropriate)
5. You **must not** ask user to input cards-all the cards for players and the House (computer in this case) should be randomly generated from the 'shuffled' deck.

Sample output is given in the appendix.

Indicative Marking Schedule:

Correct program output (Appropriately identified and defined of 5-6 *class(s), fields, methods, appropriate property(s), appropriate constructor, OO constructs (inheritance, polymorphism, use of data hiding principle…*): 25 Marks. Marks will be deducted according to the pre-defined rubric if the program does not meet one or more of the criteria above.

Part II

In this part, you will identify suitable data structures for a given form. You will also write codes for searching, sorting algorithms and a solution using divide and conquer strategy using C# console application and analyse their efficiency.

Task 1 **[15 Marks]**

Examine the 'WelTec application to re-enroll' form provided in the assignment supplementary files folder.

a. Write suitable data structures to represent each of the first 5 sections(tabs) along with corresponding datatypes to represent their elements/fields.

   For example:

   For section Contact details: Address can be represented by a "struct" and its members as follows

```
struct Address
 {
     string houseNumber;
     string streetNumber;
     string city, country;
     int post-code;
 }Home_address, Postel_address, Study_address;
```

   Find a way to include phonenumbers with the above data structure.[1]

Task 2 **[4+6+4+1=15 Marks]**

For this task there are two files given in the supplementary files folder unsorted_data.csv and sorted_data.csv.

a. Assume that you have all the lastnames available from the form in Task 1 and you have saved the data in a file- 'unsorted_data.csv'. Write a C# console program to search a given 'string'(Lastname) from the given file using sequential search algorithm.

b. Assume that you have all the lastnames available and you have saved the data in a file- 'sorted_data.csv'. Write a C# console program to search a given 'string'(Lastname) from the given file using binary search algorithm.

[1] You will be writing a full program with GUI for similar form in one of your lab assignments. For this task you would just identify data structures for sections.

c. Search following 'Lastnames' using both implementations above (Task 1a and Task1b)

Lastname	Sequential Search Runtime	Binary Search Runtime
Singh		
Tauras		
Hasha		
Dazi		

Measure and comment on runtime performance for each run.

d. Comment on theoretical performance-big -O Analysis.

Task 3 **[4+4+4+3=15 Marks]**

Write a program that sorts all the "firstnames" from the file 'unsorted_data.csv' using each of the basic sorting algorithm (Insertion, Bubble, Quicksort). Record and comment on time taken (Runtime) by each algorithm.

Task 4 **[20 Marks]**

WelTec plans to switch from physical mail to email for billing students for their tuition fees. One of the main task for admins here is to check that all the email addresses in their student database are valid. As far as Weltec admins are concerned, valid email addresses should be converted to lowercase, and have the following format:

- A username
- An "@" symbol
- A domain name
- A dot (".")
- A domain extension

The username and domain names must be alphanumeric but may have multiple parts separated by single dots (."). Parts of the username may be similarly separated by single hyphens ("-") and/or underscores ("_"). As an additional security measure, some addresses have replaced the @ symbol with "_at_" and the dot (before the extension) with "_dot_". These substitutions should be corrected. Given

that all WelTec students are based in New Zealand, Australia, Canada, U.S.A., or Great Britain, the domain extension must be one of the following:

co.nz	com.au	co.ca
co.us	co.uk	com

Alternatively, the domain may be given in numerical form, in which case it must be surrounded by square brackets(for ex: [192.18.2.168)]

Your Task is to:

Write a program that will read email addresses from a file and—for each line it reads—either display the required version (all in lower case- if it is valid) or indicate what is wrong (if it is not valid).

Sample inputs, outputs (both valid, invalid) are given in the Appendix B below.

Hint: Use divide and conquer strategy

Indicative Marking Schedule:
Correct program with all test case passes: 20 Marks.

a. If one of the test case fails: 18 Marks.
b. If two of the test case fails: 15 Marks .
c. If three or more test case fails, but program runs without error and checks a few cases correctly: 12marks

Bonus question (can recover up to 7 marks which you may have lost in above tasks):

Can you give/analyse theoretical performance of your solution for email problem (Task4)?

Part III

Short answer questions **[4*5=20 Marks]**

Please use examples and well labeled diagram(s) wherever appropriate.

i. Explain the concept of exceptions and exception handling, when they are used and how to catch exceptions.
ii. Differentiate between 'class' and 'struct' in C#.
iii. Explain the possible reason a class in C# can only inherit from a single class, while being able to implement multiple interfaces. Explain the sequence of constructors that will be called when you create an object that is an instance of a derived class
iv. Write short note on Big-O Analysis of Algorithms.
v. Explain briefly dynamic programming and, backtracking.

A Note on Plagiarism

i. Please be aware that dishonest practices will not be tolerated and will be dealt in accordance with WelTec policy.
ii. Code that is not original is usually very easy to identify.

Submission:
Submission should be done electronically via Moodle (course page): Make separate folders for each of the tasks.

References:

1. John Sharp, Microsoft Visual C# Step by Step, 8th edition. Microsoft Press, ISBN: 978-1-5093-0104- 1
2. Timothy A Budd, An Introduction to Object-Oriented Programming, ISBN 0-201-76031-2, 2002.
3. Singh, M. Lecture Notes (Slides). Moodle (WelTec intranet).
4. Nicolas Pronost, Game Engine Programming, http://www.cs.uu.nl/education/vak.php?vak=INFOMGEP
5. Course notes-326, University of Otago (cs.otago.ac.nz)
6. Michael McMillan, Data Structures and Algorithms using C#, Cambridge University Press
The Edinburgh Building, Cambridge CB2 8RU, UK

Appendix A:

Part II (Task 3 sample output)

```
Welcome to the Blackjack
How many players (1-7)? : 3
Enter player name : Manish
Enter player name : Richard
Enter player name : Quingyang
Manish: 6C  3C  -- 9
Richard: 4D 9C – 13
Quingyang: 7S  KD – 17
House :  XX 10 D
Manish do you want a card ?  y
6C 3C 8D  - 17
Manish do you want a card ?  n
Richard do you want a card ? y
4D 9C QS -> 23
Quingyang : Do you want a card ? n
7S  KD – 17
House : 3C 10D 10S – bust!
Manish Wins!
Richard Loses !
Quingyang Wins !

Do you want to continue playing (y/n) : _
```

Appendix B:

Part II (Task 2) Sample test cases and outputs [6]

Sample inputs and outputs for valid and invalid cases are given in the supplementary files folder.

Please note you are not required to output exact error message. Indicating error and give some indication as 'invalid character in username' or invalid character in 'invalid character in domain' is sufficient.