# School of Computing and Information Technology

## ASSIGNMENT 2
### (Individual)

## CSIT113 – Problem Solving

## Session 1, January – March 2024

| | |
|---|---|
| UOW Moderator: | Prof. Willy Susilo (wsusilo@uow.edu.au) |
| Lecturer: | Dr Hee Beng Kuan Tan (hbktan@uow.edu.au) |
| Total No of Questions: | Eight (8) questions |
| Total Marks: | 100 marks |
| Weightage: | 8% of total subject mark |

**Objective**

In this assignment, students are assessed on the understanding of the materials from Unit 5 to Unit 7 in the lecture notes. Students are required to apply the appropriate strategies and methods discussed in these units for each of the problems stated in the questions in this assignment.

**Question 1 [12 marks]:**

Consider the instance of discrete knapsack problem with the knapsack capacity 800 and the item information as follows:

| Item | Weight | Value |
|------|--------|-------|
| 1 | 600 | $36,000 |
| 2 | 400 | $23,200 |
| 3 | 400 | $23,200 |
| 4 | 160 | $7200 |

Find the most valuable subset of the items that fits into the knapsack using Greedy Approach. Examine your solution carefully to check whether your solution is optimal and explain the reason of your finding.

**Question 2 [12 marks]:**

A factory produces custom widgets according to customer requirements. It has several orders, each for a single widget. For each order, we know the following information:

i)  The profit that the factory will make from the order.
ii) The deadline – the last day on which the customer will accept delivery.

The factory can make exactly one widget per day. The following table shows all the orders for a 6-day period:

| Order No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-----------|---|---|---|---|---|---|---|---|---|----|
| Profit | 10 | 20 | 90 | 40 | 50 | 100 | 70 | 80 | 30 | 60 |
| Deadline | 6 | 6 | 1 | 3 | 4 | 1 | 2 | 4 | 3 | 4 |

Use Greedy Approach to determine the orders that the factory should accept and the schedule for producing the widgets of the accepted orders. Explain the result for each step in using the approach.

# Question 3 [12 marks]:

The following is a sequence of six numbers:

| 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 128 | 242 | 202 | 150 | 172 | 134 |

Use Selection Sort to sort the six numbers in the sequence into **descending.** Show the result of each step by showing the whole sequence in a new line with sorted numbers underlined.

## Question 4 [12 marks]:
The following is a sequence of five numbers:

| 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 19 | 17 | 15 | 11 | 13 |

Use Insertion Sort to sort the five numbers in the sequence into **descending** order. Show the result of each step by showing the whole sequence in a new line with sorted numbers underlined.

## Question 5 [12 marks]:
The following is a sequence of six numbers:

| 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 14 | 71 | 51 | 25 | 36 | 17 |

Use Bubble Sort to sort the six numbers in the sequence into **descending**. Show the result of each pass by showing the whole sequence in a new line with sorted numbers underlined

## Question 6 [12 marks]:
The following is a sequence of eight numbers:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 350 | 100 | 250 | 400 | 300 | 50 | 200 | 150 |

Use QuickSort to sort the numbers in the sequence in **ascending** order. Show the result of each step by showing the whole sequence in a new line with sorted numbers underlined.

## Question 7 [16 marks]:
Perform a Binary Search on the following given sequence of numbers to find each of the targets:

| 1 | 2 | 4 | 7 | 9 | 11 | 17 | 23 | 27 | 30 | 34 | 38 | 43 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

(a) The target is 38
(b) The target is 25

State clearly the values of "First", "Mid", "Last", the comparison made with the target for each step, and the conclusion found

## Question 8 [12 marks]:

Use divide-and-conquer strategy to design a recursive algorithm to find the largest number in a nonempty sequence of n numbers.