Ollscoil Chathair
Bhaile Átha Cliath
Dublin City University

SEMESTER 1 EXAMINATIONS 2021/2022

MODULE: CA314 - OO Analysis and Design

PROGRAMME(S):

CASE	BSc in Computer Applications (Soft.Eng.)
ECSAO	Study Abroad (Engineering & Computing)
ECSA	Study Abroad (Engineering & Computing)

YEAR OF STUDY: 3,O,X

EXAMINER(S):

Renaat Verbruggen	(Internal)	(Ext:5257)

TIME ALLOWED: 2 Hours

INSTRUCTIONS: **Answer all questions.**

PLEASE DO NOT TURN OVER THIS PAGE UNTIL YOU ARE INSTRUCTED TO DO SO.
The use of programmable or text storing calculators is expressly forbidden.

There are no additional requirements for this paper.

QUESTION 1 ***[TOTAL MARKS: 20]***

Q 1(a) **[15 Marks]**

Read the Appendix describing an Air ventilation Unit and complete the following:

Write three Use Cases to describe: Setup System; Monitor CO_2 level ; Monitor Heat. Use Cockburn's template in each case.

Q 1(b) **[5 Marks]**

Draw a Use Case Diagram to represent your answer to 1(a) and add in two new use cases - one that is a <<use>> and one that <<extends>>.

[End of Question 1]

QUESTION 2 ***[TOTAL MARKS: 20]***

Q 2(a) **[10 Marks]**

Draw a Class Diagram to represent the Appendix describing an Air Ventilation Unit. Show two sample attributes and functions for each class

Q 2(b) **[5 Marks]**

Explain the difference between a dependency association and inheritance in a UML Class Diagram

Q 2(c) **[5 Marks]**

Show how and where you might add a new Light sensor to your Class Diagram.

[End of Question 2]

QUESTION 3 ***[TOTAL MARKS: 20]***

Q 3(a) **[14 Marks]**
Draw an overall State Diagram to represent the Air Ventilation Unit using Harel's UML approach. Ensure that you represent all of the parallelism.

Q 3(b) **[6 Marks]**
Check your guard conditions on the transitions in the State Diagram and show how a separate diagram could show a lighting sensor with settings for four rows of lights: Podium, Front Seats, Back Seats, All.

[End of Question 3]

QUESTION 4 ***[TOTAL MARKS: 20]***

Q 4(a) **[10 Marks]**
Draw a UML Component Diagram showing Provided and Required interfaces as ports for the HEAT sensor within the Air Ventilation Unit.

Q 4(b) **[10 Marks]**
Explain why designing using Interfaces can lead to improvements in systems. You can refer to both Design by Contract and group development.

[End of Question 4]

QUESTION 5 ***[TOTAL MARKS: 20]***

Q 5(a) **[4 Marks]**
Describe your core roles in the group project.

Q 5(b) **[6 Marks]**
What was the most difficult aspect of the project for yourself and separately for the group?

Q 5(c) **[10 Marks]**
If the project was repeated commercially how would you address the design principles of efficiency, reuse and robustness ?

[End of Question 5]

APPENDIX

Air Ventilation Unit

The brief specification of a new air ventilation unit would include three main subsystems:

1. A set of 3 sensors for the measurement of heat, CO_2 (Carbon Dioxide) and ozone.
2. A fan system that can be set to High, Low and OFF.
3. A Heating Element that can be set to 20^o, 16^o, 14^o Celsius.

The system will have a control panel allowing the setting of initial values but once running the system should work automatically to control the temperature and air quality.

Standard cut-off points would be that CO_2 stays between 400 and 800 parts per million. If it goes beyond 800 the fan should move to HIGH until it drops to 600.

If the temperature drops 2 degrees below its setting the heat should turn on until it is 2 degrees above its setting.

Ozone levels should be below 0.08 parts per million (ppm) again the fan should be switched on to maintain this.

Finally if after the Fan is on HIGH for 20 minutes and the ozone or CO_2 have not dropped below their safe levels an alarm should sound to indicate that the room should be vacated.

[END OF APPENDICES]

[END OF EXAM]