ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **Summer Semester: 2020-2021**

DURATION: 1 HOUR 30 MINUTES **Full Marks: 75**

SWE 4805: Software Verification and Validation

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer **all 3 (three)** questions. Marks of each question and corresponding CO and PO are written in the brackets of the right margin.

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1. a) Write 5 (five) differences between Software Verification and Validation with definition. 10 (CO1) (PO1)

   b) What is Unit Testing? How to write Unit Testing considering Black box and White box testing? 5 (CO1) (PO1)

   c) Testing techniques are categorized into Black box, White box, and Gray box testing techniques. Write 5 (five) differences among them. 10 (CO1) (PO1)

2. Consider the following Alloy code and answer the subsequent questions.

```
abstract sig Person {
            spouse: lone Person,
            parents: set Person
}
sig Man, Woman extends Person{}
one sig Adam extends Man {}
one sig Hawa extends Woman {}
```

   a) Describe the above code snippet in natural language. 5 (CO1) (PO1)

   b) Explain the following facts in natural language. 10 (CO2) (PO1)
      i. all p: Person | lone p.parents & Woman and lone p.parents & Man
      ii. no p: Person | p in p.^parents
      iii. no p: Person | p.spouse in p.parents.(~parents)
      iv. Hawa in Adam.spouse
      v. all p: Person - (Adam + Hawa) | # p.parents = 2

c) Analyze the following assertions. 10

i. assert {no p: Person | p in p.spouse} (CO2)

ii. assert {no p: Person | some (p.^parents & p.spouse.^parents)} (PO2)

iii. assert {all p: Person | no (p.parents & p.spouse)}

iv. If any counterexample is found from the above assertions, what will be the probable way to make the SRS valid?

3 Consider the SRS and answer the following questions in Alloy.

We are building an application of IUT CSE department having **courses** and 3 (three) different categories of **persons** such as **Faculty**, **Student**, and **Instructor**. **Students** can be either **Graduate** or **UnderGraduate**. In other words, No student can be both a **Graduate** and an **UnderGraduate**.

-Every **student** has one **ID** as ***Id*** and a set of **courses** as ***transcripts***.

-Every **course** is ***taught by*** one **instructor**.

-Every **course** is ***enrolled by*** one or more **students**.

-For every **course**, there can be zero or more **students** as ***waitlist***.

-Every **course** can have zero or more ***prerequisite*** **courses**.

a) Define **signatures** and ***fields***. 5 (CO1) (PO1)

b) Write the following constraints in Alloy as fact. 10

i. All instructors are either faculty or graduate students. (CO2)

ii. No two distinct students have the same ID. (PO1)

iii. For every course, the corresponding instructor is not enrolled in for that course.

iv. No one is waiting for a course unless someone is enrolled.

v. A student's transcript contains a course only if it contains the course's prerequisite.

c) Verify and validate every statement in Alloy as an assertion. 10

i. There is a graduate student who is also an instructor. (CO2)

ii. A course doesn't have itself as a prerequisite. (PO2)

iii. For every course, no instructor is on the waitlist for a course that s/he teaches.

iv. For every course, no student is enrolled and on the waitlist at the same time.

v. There is a course with prerequisite and enrolled students.