1 (40 Marks) Short Answer: Concepts

1.1 (8 Marks) Name the four stages of the waterfall model for software development. Briefly describe the activities of each stage and the artifacts produced in each stage.

1.2 (6 Marks) What is the major benefits and problems of the evolution model for the life cycles of software development? What is the difference between the evolution model and the waterfall model.
1.3  **(8 Marks)** List four different kinds of stakeholders and their roles in the requirements process.

1. 

2. 

3. 

4. 

1.4  **(10 Marks)** List and briefly describe five different kinds of requirements elicitation approaches. Indicate the ones that can be used to elicit requirements from an existing system.

1. 

2. 

3. 

4. 

5.
2 (60 Marks) UML Specification

The following questions ask you to write parts of the requirements specification for a heating system of a house.

The heating system consists of a furnace and a digital thermostat. The thermostat has a controller, which will communicate with the furnace. The thermostat has a key pad with 10 digits, an “on” button, and an “off” button on it. The thermostat also has an LCD display that shows at anytime the two digits that are dialed in by the user with the key pad as the desired temperature, and a sensor that measures the house temperature. If the house temperature is two-degrees lower than the desired temperature, the controller will activate the furnace; if the house is two-degrees higher than the desired temperature, the controller will deactivate the furnace. A fault can occur in the furnace. The controller can be reset after the fault recovery, and the furnace can be restarted by the controller once the controller is reset by the user.

The input signals (events) to the heating system are:

- **N**: user dials a digit to set the desire temperature
- **O**: user turns on the system
- **F**: user turns off the system
- **R**: user resets the controller

The output signals (events) from the system are:

- **T**: the LCD display shows “– –”, when user pushes the “on” button
- **D**: the LCD display shows “d d”, when the two digits, “d”, “d”, are dialed
- **E**: the LCD display shows “E E”, when there is an error in the furnace
2.1 (15 Marks) UML Use Case diagram

Build a Use Case diagram for the heating system. Show the system boundary, all actors, and all use cases in the diagram.
2.2 (15 Marks) UML Sequence diagram

Build a Sequence diagram for the following scenario:

1. The user dials “7” and “5” as the desired temperature;
2. The LCD displays “75”;
3. The sensor sends the desired temperature “75” to the controller;
4. The controller requests the current temperature of the house;
5. The sensor measures that the house temperature and sends the current temperature of “70” to the controller;
6. The controller generates an “activation” signal to start the furnace.
2.3 (15 Marks) UML Class diagram

Draw a UML Class diagram for the heating system. Show all the attributes and operations of each class. Show the environmental actors on your diagram. Show all possible aggregations (composition), generalizations, and associations among classes. Show the labels and multiplicities on the associations.
2.4  **(15 Marks) UML State diagram**

Draw a UML state diagram to describe the behavior of the *furnace* class.