NTNU – Trondheim
Norwegian University of
Science and Technology

Department of Computer and Information Sciences

# Examination paper for TDT 4242
# Software Requirements and Testing

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**Examination date: June 7, 2014**

**Examination time: from 09:00 AM to 1:00 PM**

**Permitted examination support material: Code A**
**Pocket calculators allowed**
**All printed and handwritten material is allowed**

**Other information: -**

**Language: English**

**Number of pages: 4**

**Number of pages enclosed: 2**

**Checked by:**

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Date Signature

# Introduction

In this exam you can score a maximum of 50 points. The remaining 50 points for the semester comes from the compulsory exercises.

If you feel that any of the problems require information that you do not find in the text, then you should

- Document the necessary assumptions
- Explain why you need them

Your answers should be brief and to the point.

# Problem 1 – Requirements engineering (20 points)

## *1a – Temporal patterns – 10 points*

1. Use the defined set of temporal patterns – see appendix 2 – to describe the three upper levels of the requirements to a control unit for a tool cell.
2. Explain the difference between “Maintain(Condition) “ and “Achieve(Condition)”.

## *1b – Textual use cases – 10 points*

1. Convert the requirements in appendix 1 to textual use cases

# Problem 2 – Testing methods (15 points)

Appendix 3 shows the state diagram for a seatbelt controller. The controller gives an alarm if a person sits down in the seat and has not buckled up within a certain time. If the alarm is activated, it will keep on until the seatbelt is fastened or the person leaves the seat.

## *2a – Methods choice – 5 points*

It is important for the car manufacturer that the seatbelt controller is well tested.

1. Choose a test method and explain why you chose this method.

## *2b – Testing methods – 10 points*

1. Write four complete tests for the seatbelt controller, given the method you chose in problem 2a-1

# Problem 3 – Scenario testing (15 points)

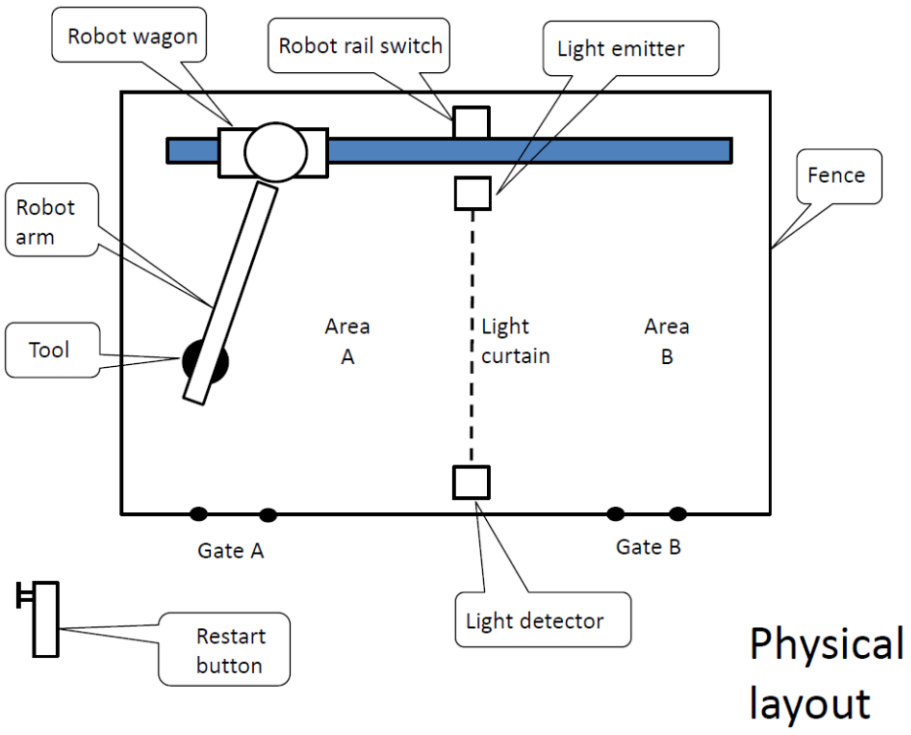
Even if we can test all the functions and elements in the tool cell control unit described in appendix 1, the company where the control unit will be installed require that we also need a good test of the system in operation. They therefor as us to perform a scenario test

1. Explain what a scenario test is and why it can be important
2. Select two scenarios and explain why they are important
3. Give a complete description of the two scenarios.

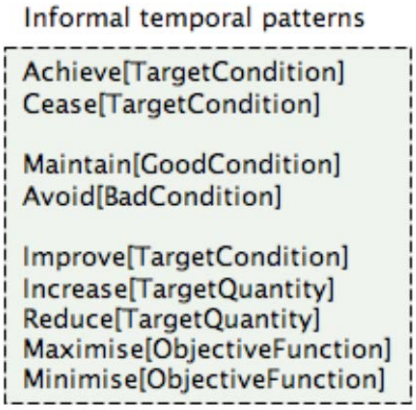
# Appendix 1 – Tool Cell

## Requirements – natural language

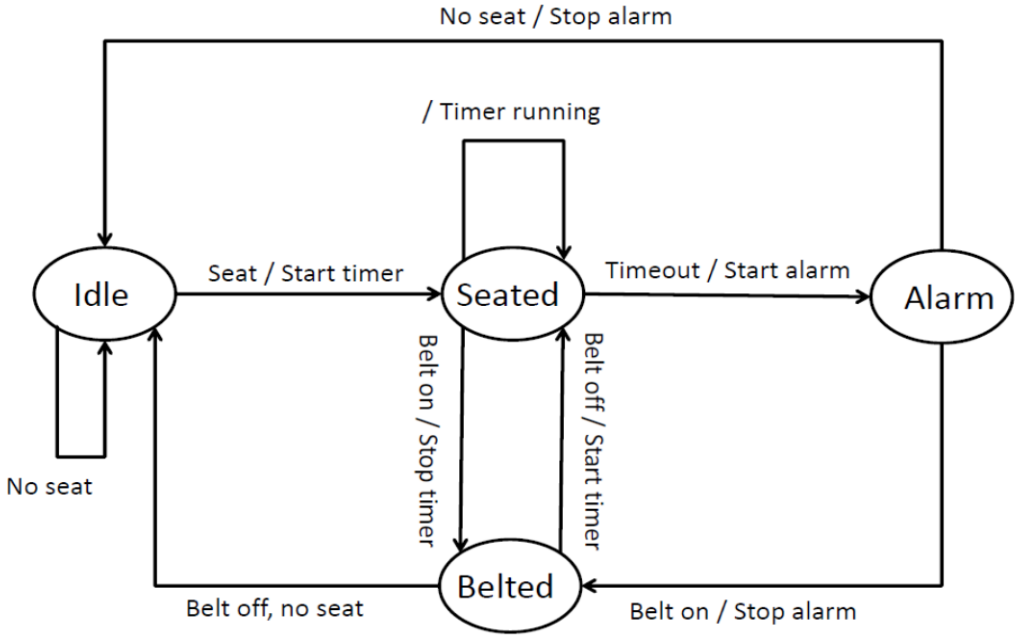
1. If the robot is in area A and gate A is opened, the robot shall stop within 20 ms.
2. If the robot is in area B and gate B is opened, the robot shall stop within 20 ms.
3. If the light curtain is broken, the robot shall stop within 20 ms.
   => Personnel enters robot area.
   *Light curtain*: one or more pairs of light emitters and light detectors. If the light beam from emitter to detector is broken, a signal is sent to the controller.
4. If the robot rail switch is activated and the gate is open in the area that the robot moves into, the robot shall stop within 20 ms.
   => Robot enters personnel area.
5. Stop robot => stop tool, robot wagon and robot arm
6. If the system has stopped it can only be restarted by pressing the restart button. The restart button shall only work if both gates (gate A and gate B) are closed and the light curtain is un-broken – the light detector receives light from the light emitter.
7. The operator shall check that there are personnel in neither area A nor area B.
8. The gate shall remain open if an operator has entered the corresponding area.
   => Used as an indicator that there is personnel in the area
9. Each gate has a gate sensor
10. Area A and area B are separated by a light curtain consisting of a light emitter and a light detector
11. On the rail, area A and area B are separated by a rail switch which is changed when the robot moves past it



# Appendix 2 – Temporal patterns for requirements




# Appendix 3 – Seat belt alarm – one alarm per seat




- "Seat" – someone is sitting in the seat
- "No seat" – no person is sitting in the seat