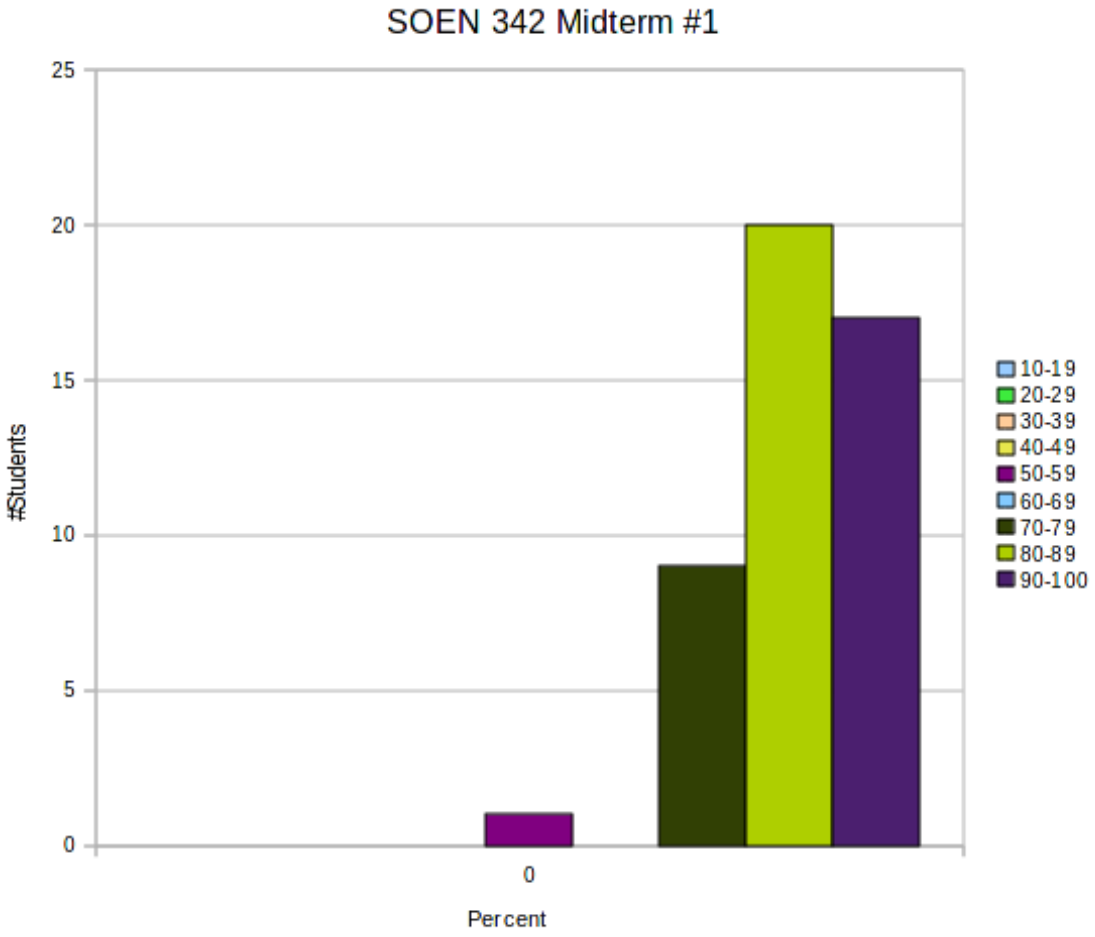
SOEN 342 Software Requirements

Fall 2009/2010

Midterm Exam #1 – Solutions

Name: _____ Total Points:

ID: _____ _____ / 25



	Q1	Q2	Q3	Q4	Q5	Total
Average	1.9	2.79	3.26	7.24	6.1	21.29
Percent	95.21	92.91	65.11	90.56	87.08	85.15

(2pts) **1.** Name five *defects* that can appear in a requirements document and provide a one-sentence definition for each.

2 pts

1. Name: _____

   Definition: _____

2. Name: _____

   Definition: _____

3. Name: _____

   Definition: _____

4. Name: _____

   Definition: _____

5. Name: _____

   Definition: _____

Solution: See the [AvL] textbook, p.37 or the lecture slides 4b for a list of defects together with a brief definition.

Marking: $\frac{1}{2}$ pts. off for wrong/missing defects or wrong/insufficient definition.

(3pts) **2.** Consider the following interaction matrix:

	3 pts

Statement	S1	S2	S3	S4	Total
S1	0	1000	1	1	1002
S2	1000	0	0	1000	2000
S3	1	0	0	1	2
S4	1	1000	1	0	1002
Total	1002	2000	2	1002	4006

Here, S_{ij} =

- 1: conflict
- 0: no overlap
- 1000: no conflict

(a) (1 pt) Compute the values for the total row and column and insert them in the table above.

(b) (1 pt) Use the formula discussed in the lecture to compute the total number of *conflicts*: 6

(c) (1 pt) Use the formula discussed in the lecture to compute the total number of *non-conflicting overlaps*: 4

Background: This question covers the documentation of conflicts, see the [AvL] textbook Chapter 3.1.3 or lecture slides 4a for details.

Solution: for the total row and columns, simply add up the values (note that there were different tables in different exams).

The number of conflicts is computed as the remainder of the integer division of 4006 by 1000 = 6.

The number of non-conflicting overlaps is the quotient of the integer division of 4006 by 1000 = 4.

Marking: For (a), $\frac{1}{2}$ pts. off for each wrong/missing table entry.

Full marks for (b) and (c) if the stated number matched the table *Total*. Half marks ($\frac{1}{2}$) if result was wrong, but correct formula was given.

(5pts) **3.** You elicited the following requirements for a library loan system:

5 pts

1. A book can be on stack if and only if it is not on reserve or on loan
2. A book can be on reserve if and only if it is not on stack or on loan
3. A book can be on loan if and only if it is not on reserve or on stack
4. A book can be requested if and only if it is on stack or on reserve

(a) (2 pts) Translate these requirements into propositional logic:

Using the following abbreviations:

BS	book can be on stack
BR	book can be on reserve
BL	book can be on loan
BQ	book can be requested
R	book on reserve
S	book on stack
L	book on loan

a possible translation is:

1. $BS \leftrightarrow \neg(R \vee L)$
2. $BR \leftrightarrow \neg(S \vee L)$
3. $BL \leftrightarrow \neg(R \vee S)$
4. $BQ \leftrightarrow S \vee R$

(b) (2 pts) Consider the two requirements 1. and 3. together. Are they *consistent*? Prove or disprove:

Solution: We have to find a *model* for the requirements set

$$S = \{r_1, r_3\} = r_1 \wedge r_3 = [BS \leftrightarrow \neg(R \vee L)] \wedge [BL \leftrightarrow \neg(R \vee S)]$$

One possible model is $R = T, L = F, BS = F, S = T, BL = F$, so the requirements are consistent.

(c) (1 pt) Consider a requirement represented as a propositional logic formula r that is *valid* (written $\models r$). This means (check only one answer):

- [x] the requirement is *redundant*
- [ ] the requirement is *inconsistent*
- [ ] the requirement is *ambiguous*
- [ ] the requirement is *illogical*
- [ ] the requirement is *unsatisfiable*
- [ ] nothing – has no particular impact for the requirements specification

Background: Part (a) covered formal requirements specification using propositional logic (lecture 5b), and parts (b) and (c) formal requirements quality assurance (lecture 6a).

Solution: see above.

Marking: For (a) several translations were possible (in particular with the scope of the negation); as long as they were consistent, full marks were given.

For (b) full marks for stating that they are consistent and a (reasonable) proof attempt. Half marks (1pt) were given when result/proof were incorrect/inconsistent, but did show some correct approach.

(8pts) **4.** You are the requirements engineer in an information system project for a video rental store. Simplifying assumptions and details:

8 pts

- It is a stand-alone store, not part of a larger organization.
- Rents only videos, not computer games or other items.
- A "video" can be in any medium: tape, DVD, and so on.
- The rental charge may vary by medium. For example, DVD rentals are more expensive than tapes.
- The store does not sell anything. For example, there are no sales of videos or food.
- All transactions are rentals.
- The input medium by which membership and video rentals are captured is not important.
- Cash-only payments.
- On completion of a rental, the customer receives a transaction report with 'typical' information on it (use your judgement).
- Each renter has a separate membership.

(a) (1 pt) Identify 4 *actors* and give a brief description (3–5 words) for each

- **Actor 1:** Name: Customer

  Description: Video store customer, renting videos
- **Actor 2:** Name: Clerk

  Description: Video store clerk
- **Actor 3:** Name: Manager

  Description: Video store manager
- **Actor 4:** Name: Video Review System

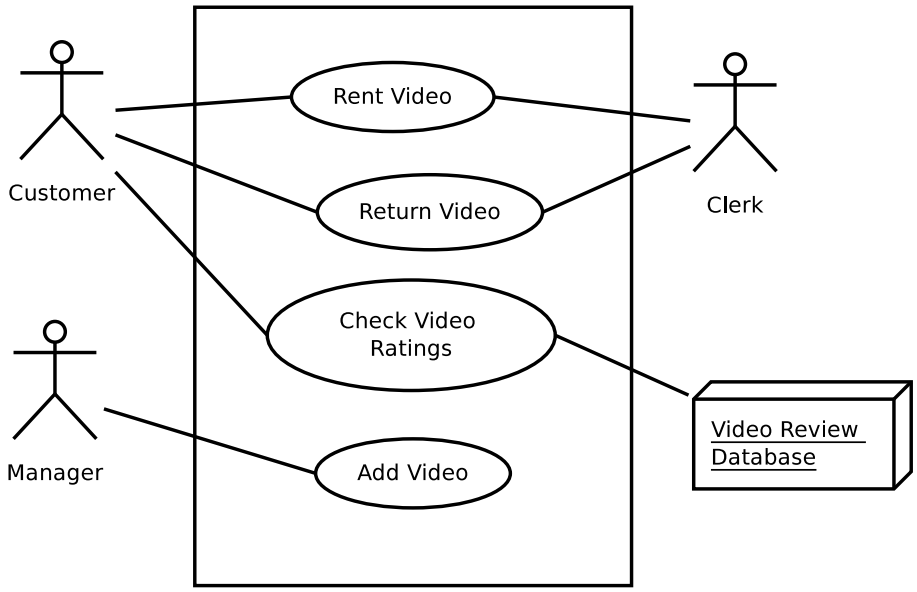
  Description: Existing database of video reviews

⇒ ***Continued on next page!***

(b) (2 pts) Identify four primary (user-goal level) use cases and related actors (identified by A1, A2 etc.):

- **UC1** Name: **Rent Video** Actors: **A1, A2**
- **UC2** Name: **Add Video** Actors: **A3**
- **UC3** Name: **Return Video** Actors: **A1, A2**
- **UC4** Name: **Check video ratings** Actors: **A1, A4**

(c) (1 pt) Draw the UML use case context diagram for your actors and use cases:



⇒ ***Continued on next page!***

(d) (3 pts) Write the use case (steps only, no additional details like pre- and postconditions) for "Rent Video" in *essential* style, for the main success scenario (basic flow):

1. This use case begins when a Customer arrives at a checkout with videos to rent.
2. The Customer presents their membership identification to the Clerk, who enters it into the system.
3. System presents membership information, and status of loans.
4. For each video, the Clerk records the item identification into the system.
5. System presents accumulating list of rental video titles, due dates, and total rental fee.
6. Clerk informs Customer of total rental fee, and asks for payment.
7. Customer pays cash to Clerk.
8. Clerk records payment into system.
9. System generates receipt and loan report.
10. Clerk gives receipt and loan report to Customer.

(e) (1 pt) Write two extensions (alternative scenarios) for the "Rent Video" use case. Provide the step number in the main success scenario and a brief description.

- **2** : **Add membership**
- **7** : **Pay with credit card**

Solution: One possible (but certainly not the only) solution is shown above.

Marking: *(a)* $\frac{1}{2}$ points for each sensible actor/description. *(b)* $\frac{1}{2}$ points for each sensible use case name and actor combination. *(c)* full marks for showing the use cases and actors in the context diagram, including system boundary. *(d)* full marks for a reasonable use case specification. In particular, marks were taken off if the description was too short (less than ca. 5 steps), too detailed, did not have a clear trigger event, were missing the transaction record, or did include steps not relevant for a functional specification of the software system (customers walking around the store, watching the movie, making popcorn) or steps belonging to a different use case (becoming members, returning videos). For *(d)* $\frac{1}{2}$ marks for each reasonable extension.

(7pts) **5.** Consider the following Defect Detection Prevention (DDP) risk-consequence table for a library loan management system:

	7 pts

Objectives	**Risks**				**Loss of objective**
	Late returns (likelihood: 0.6)	Stolen copies (likelihood: 0.3)	Lost copies (likelihood: 0.1)	Long loan by staff (likelihood: 0.5)	
Regular availability of book copies (weight: 0.4)	0.30	0.60	0.60	0.20	0.208
Comprehensive coverage of library (weight: 0.3)	0	0.20	0.20	0	0.024
Staff load reduced (weight: 0.1)	0.30	0.50	0.40	0.10	0.042
Operational costs decreased (weight: 0.1)	0.10	0.30	0.30	0.10	0.023
Risk criticality	0.096	0.114	0.037	0.05	

With

$$Criticality(r) = Likelihood(r) \times \sum_{obj} (Impact(r, obj) \times Weight(obj))$$

and

$$Loss(obj) = Weight(obj) \times \sum_{r} (Impact(r, obj) \times Likelihood(r))$$

(a) (1 pt) What is the meaning of a single table entry, i.e., of each pair (obj, r)?

- [x] (estimated) loss of satisfaction of objective *obj* if risk r occurs
- [ ] relative cost to recover objective *obj* if risk r occurs
- [ ] this is the risk-reduction leverage (RRL)
- [ ] the (estimated) reduction of risk r under objective *obj*
- [ ] None of these options

(b) (2 pts) Compute the values for *Loss of objective* and enter them in the last column of the table.

(c) (2 pts) Compute the values for *Risk criticality* and enter them in the last row of the table.

(d) (1 pt) Which *objective* is most at risk?

- [x] Regular availability of book copies
- [ ] Comprehensive coverage of library
- [ ] Staff load reduced
- [ ] Operational costs decreased
- [ ] None of these options

(e) (1 pt) What is the *highest risk* overall? Stolen copies

Background: This question covers *risk assessment* using the DDP approach; see the [AvL] textbook and the lecture slides 04a for details.

Solution: see above

Marking: *(b)* and *(c)* $\frac{1}{2}$ points for each correct table entry (note that there were different tables in different exams). Marks for *(d)* and *(e)* if answer matched the results computed in the table.

— End of Exam Solutions —