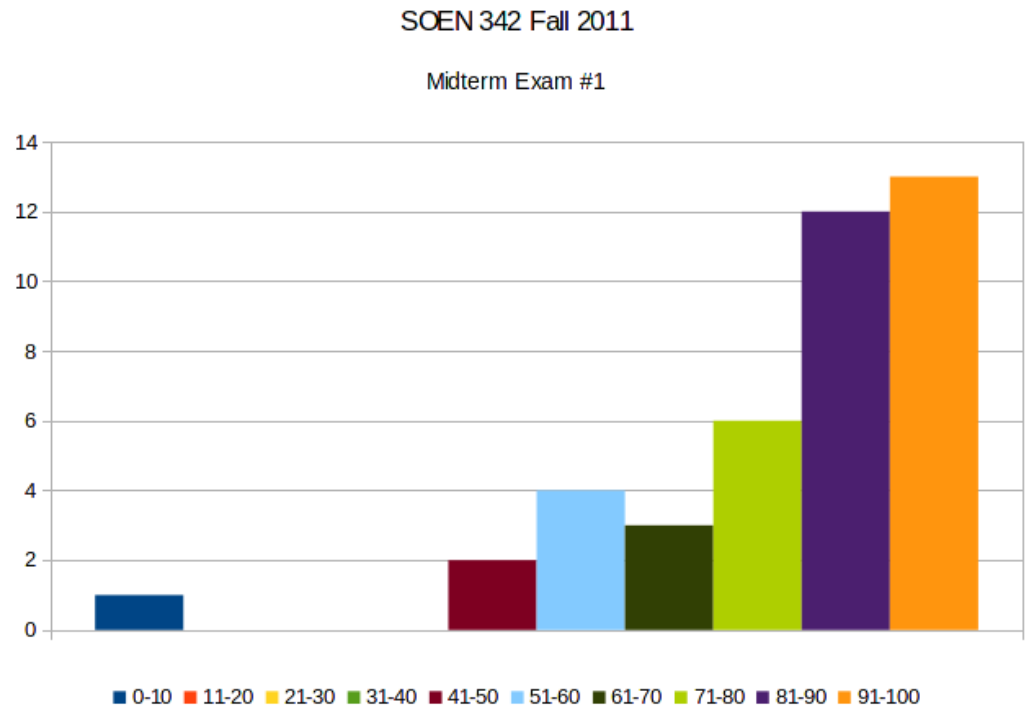
SOEN 342 Software Requirements Specifications

Fall 2011

Midterm Exam #1 – Solutions and Marking

Name: _____ Total Points:

ID: _____ _____ / 25



	Q1	Q2	Q3	Q4	Q5	Total
Average	1.73	3.81	4.13	5.56	5.20	19.93
Percent	86.25	76.25	82.50	92.71	74.29	79.71

Remember that the overall grading for the course will be on a curve, so there is no direct relationship between the (absolute) marks and the (relative) letter grade. Also, keep in mind that this midterm only accounts for 25% of the overall course marks, so it is not a reliable predictor for your final letter grade.

(2pts) **1.** Provide *brief* answers to the following questions.

2 pts

1. Name three different *non-functional requirement (NFR)* types:

   (1) **Security**

   (2) **Usability**

   (3) **Maintainability**

2. Name three different *process lifecycle models* for software development:

   (1) **Unified Process**

   (2) **Waterfall**

   (3) **Scrum**

3. Name three different *defects* that can occur in a requirements document:

   (1) **Ambiguity**

   (2) **Contradiction**

   (3) **Overspecification**

4. Name three different *requirements elicitation* techniques:

   (1) **Interviews**

   (2) **Questionnaires**

   (3) **Repertory Grids**

Solution. Above are some examples for correct solutions. For other possible answers, please refer to the NFR taxonomies, elicitation techniques and defects listed in the van Lamsweerde and Leffingwell/Widrig books, as well as the software engineering process models covered in Lecture #02.

Marking. $\frac{1}{2}$ marks for each sub-question (all three answers must be correct to receive the marks).

(5pts) **2.** Consider the following requirements statements that you elicited for a library book loan system:

5 pts

- S1: "Books can be on loan for a maximum period of 4 weeks"
- S2: "Users can search for books by title and author"
- S3: "A user can freely select the loan period (number of weeks) for each book"
- S4: "The loan period for a book can be shorter than the maximum period"

Your task is to detect requirements overlaps and conflicts and document them using an *interaction matrix*.

(a) (2 pts) Document the detected overlaps and conflicts in the interaction matrix below:

Statement	S1	S2	S3	S4	Total
S1	0	0	1	1000	1001
S2	0	0	0	0	0
S3	1	0	0	1000	1001
S4	1000	0	1000	0	2000
Total	1001	0	1001	2000	4002

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

(c) (1 pt) For S3, compute the number of conflicts: **1**
as well as the number of non-conflicting overlaps: **1**

(d) (1 pt) Now compute the *total* number of conflicts: **2**
as well as the *total* number of non-conflicting overlaps: **4**

Solutions. See above. Notation: $S_{ij} = 1$: conflict, 0: no overlap, 1000: overlap (but no conflict). Note that different exams had the statements in a different order; the solution above corresponds to one of these versions.

For (c) and (d), you had to compute the number of conflicts and non-conflicting overlaps as discussed in Lecture #6, by integer division:

- (c) $1001 \text{ div } 1000 = 1r1$
- (d) $4002 \text{ div } 1000 = 4r2$

Different exams had different values to compute for part (c); the solution above corresponds to one of these versions.

Marking. For (a), 2 points for correct table entries, $-\frac{1}{2}$ marks off for each error. Note that the table must be filled in completely and it must be symmetric. For (b), 1 mark for correct total values ($-\frac{1}{2}$ marks off for each erroroneous or missing entry). For (c) and (d), $\frac{1}{2}$ marks for each correct number of conflicts and overlaps.

(5pts) **3.** Consider the following requirements statements:

5 pts

1. If the item ordered is an item we stock, and the customer is an approved customer, and we have sufficient inventory on hand, then subtract the quantity ordered from the inventory count, send a shipment authorization for the item and quantity to shipping, and log this transaction.

2. If the item is not something we stock, reject the order and log the transaction.

3. If the customer is not an approved customer, reject the order and log the transaction.

4. If we stock the item, and the customer is approved, but we have insufficient inventory to fill the order, then place this order on backorder, send a notice to that effect, and add this order to the follow-up log *(Note: this log is not the same as the transaction log!)*

(a) (5 pts) Create a *decision table* to document these requirements:

Item we stock?	T	T	T	T	F	F	F	F
Approved customer?	T	T	F	F	T	T	F	F
Sufficient inventory?	T	F	T	F	T	F	T	F
Subtract quantity from inventory count	X							
Send shipment authorization	X							
Log the transaction	X		X	X	X	X	X	X
Reject the order			X	X	X	X	X	X
Place order on backorder		X						
Sent notice regarding backorder		X						
Add order to follow-up log		X						

Solutions. See above. You had to extract the conditions from the requirements statements, as well as the corresponding actions, and insert them into the table.

Discussion. This question is on requirements specification using decision tables, which was covered in Lecture #7.

Marking. $-\frac{1}{2}$ marks off for each error, such as a missing input or output conditions, or wrong logic.

(6pts) **4.** Consider the following Defect Detection Prevention (DDP) risk-consequence table for a library loan management system:

6 pts

Objectives	**Risks**			**Loss of objective**
	Late returns (likelihood: 0.6)	Stolen copies (likelihood: 0.3)	Lost copies (likelihood: 0.1)	
Regular availability of book copies (weight: 0.4)	0.40	0.60	0.60	0.192
Comprehensive coverage of library (weight: 0.3)	0	0.20	0.20	0.024
Staff load reduced (weight: 0.2)	0.30	0.50	0.40	0.074
Operational costs decreased (weight: 0.1)	0.10	0.30	0.30	0.018
Risk criticality	0.138	0.129	0.041	

(a) (3 pts) Compute the values for *Loss of objective* (last column of the table) and the values for *Risk criticality* (last row of the table); using the formulas:

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

and

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

Now assume you identified the following risk countermeasures together with domain experts (here, 0 means "no reduction of the risk" and 1 "risk completely eliminated"):

Counter-measures	**Weighted risks**			**Overall single effect of countermeasure**
	Late returns (likelihood: 0.6)	Stolen copies (likelihood: 0.3)	Lost copies (likelihood: 0.1)	
E-mail reminder sent	0.70	0	0.10	0.1007
Fine subtracted from registration deposit	0.80	0	0.60	0.135
Borrower deregistration & addition to black list	0.90	0.20	0.80	0.1828
Anti-theft device	0	1	0	0.129
Combined risk reduction	0.994	1	0.928	

(b) (3 pts) Compute the values for *Overall single effect of countermeasure* (last column of the table) and the values for *Combined risk reduction* (last row of the table); using the formulas:

$$combinedReduction(r) = 1 - \Pi_{cm}(1 - Reduction(cm, r))$$

and

$$overallEffect(cm) = \sum_{r} (Reduction(cm, r) \times Criticality(r))$$

Solutions. See above. Note that different exams had different table values; the solution above corresponds to one of these versions. For details on the DDP approach, check Lecture #06.

Marking. For parts (a) and (b), $-\frac{1}{2}$ marks for each missing or incorrect table entry.

(7pts) **5.** Your task is to prioritize a number of requirements based on the AHP method.

7 pts

(a) (1 pt) You already obtained the relative values for the requirements from your stakeholders. Fill in the remaining entries in the table below:

Objectives	Produce optimal date	Handle preferred locations	Parameterize conflict resolution strategy
Produce optimal date	1	3	5
Handle preferred locations	1/3	1	3
Parameterize conflict resolution strategy	1/5	1/3	1

(b) (2 pts) Now compute the normalized matrix: $R'_{ij} = R_{ij} / \sum_i R_{ij}$
and the relative contribution (last column): $\text{Contrib}(R_i, crit) = \sum_j R'_{ij}/N$

Objectives	Produce optimal date	Handle preferred locations	Parameterize conflict resolution strategy	**Relative value**
Produce optimal date	0.65	0.69	0.56	0.63
Handle preferred locations	0.22	0.23	0.33	0.26
Parameterize conflict resolution strategy	0.13	0.08	0.11	0.11

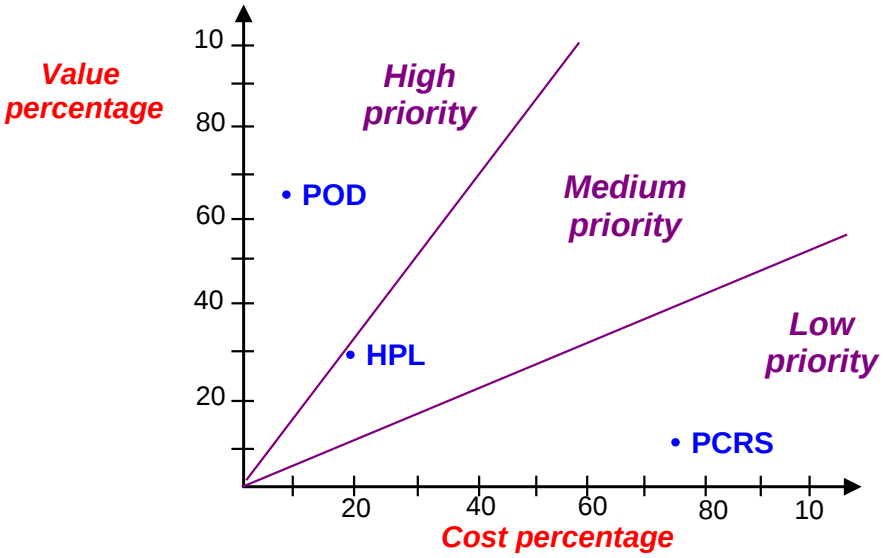
(c) (1 pt) You also obtained the *relative cost* for the requirements from your stakeholders. Fill in the remaining entries in the table below:

Objectives	Produce optimal date	Handle preferred locations	Parameterize conflict resolution strategy
Produce optimal date	1	1/3	1/7
Handle preferred locations	3	1	1/7
Parameterize conflict resolution strategy	7	7	1

(d) (2 pts) Now compute the normalized matrix as before: $R'_{ij} = R_{ij} / \sum_i R_{ij}$
and the relative contribution (last column): $\text{Contrib}(R_i, crit) = \sum_j R'_{ij}/N$

Objectives	Produce optimal date	Handle preferred locations	Parameterize conflict resolution strategy	**Relative cost**
Produce optimal date	0.09	0.04	0.11	0.08
Handle preferred locations	0.27	0.12	0.11	0.17
Parameterize conflict resolution strategy	0.64	0.84	0.78	0.75

(e) (1 pt) Enter the computed values into the cost-value graph below:



Solutions. See above. For (a) and (c), you simply had to insert "1" for the diagonal values, and the inverse ($1/R_{ij}$) for the values across the diagonal. For (b) and (d), you just had to apply the provided formulas to compute the normalized values and relative cost/value columns.
Different exams had slightly different table values; the solution here corresponds to one of these versions.

Marking. For (a) and (c), 1 point for correctly filled-in tables, $-\frac{1}{2}$ marks off for each error. For (b) and (d), 1 point each for the correct values in the table and the relative cost/value column (again, $-\frac{1}{2}$ marks off for errors in each). For (e), you simply had to plot the three calculated (cost, value) pairs into the graph, for which you received one point, as long as the plot was reasonably close to the computed values.

Discussion. AHP was covered in Lecture #06, and all formulas were provided, so you essentially only had to remember what the entries in the table mean to correctly assign the diagonal/inverse values.

— End of Exam Solutions —