1.12 Computer Models of Physical and Engineering Systems **Spring 1997**

TERM PROJECT

Part 2 Due: 9 A.M. Thursday, March 6, 1997
Part 3 Due: 9 A.M. Thursday, April 10, 1997
Final Due: 9 A.M. Thursday, May 8, 1997

Reference Readings:
Winston, Patrick Henry: Chap. All [1(All)]
Rumbaugh, et al.: Chap. 2, 3, 4, 5, 6, 7 & 8

PART 2:

(OMT Models for 2 Systems)

Your group has several engineering systems in total. Of those systems, your group should select 2 and prepare the following for each one:

- a brief description of two engineering systems (1-2 pages for each). This description will serve as your problem statement as seen in the ATM network problem page 148 of Rumbaugh *et al.* (2). Chapter 8 of that book will serve as a guide for your term project. Please read it carefully and follow it. Explain your assumptions and reasons for the description.
- an object model of your system. Your report should contain the following:
  1. a diagram of all your classes (page 154, Figure 8.6). This diagram should contain all the classes that you considered. Do not clean your model yet. You should show the evolution of the model and the iterative process that it went through. Also, you should make clear your assumptions for selecting classes.
  2. a diagram of all relevant classes (page 154, Figure 8.7). This diagram should contain all the relevant classes. This diagram should be cleaner than the previous one and you should explain the reasons for removing some of the classes.
  3. a data dictionary (page 157, Figure 8.8). Explain all the classes, their meaning, and their role.
  4. a summary of all the associations that exist between classes (page 158, Figure 8.9). This summary should contain all the associations revealed in the problem statement explicitly or implicitly. The summary should also contain the associations that derived from your knowledge of the domain. Explain your assumptions and reasons for the summary.
  5. a diagram of all relevant classes and associations (page 161, Figure 8.11). This diagram should contain all the classes that you considered relevant with their associations. The diagram should include multiplicity balls, qualifications, and roles if the problem ask for it. Explain your assumptions and reasons for the diagram.
  6. a diagram of all relevant classes and associations with their attributes (page 164, Figure 8.12). This diagram should add the attributes to the previous diagram. Remember to put attributes on the associations if the problem asks for it. Also, remember to check if an attribute should be a qualifier or not. Explain your assumptions and reasons for the diagram.

7. a diagram that uses your previous one and use inheritance to make effective use of attributes, operations and associations (page 165, Figure 8.13). This diagram should include inheritance in the form of base and derived classes. Explain your assumptions and reasons for doing the diagram.
8. a diagram that is an improvement from the last one (page 168, Figure 8.14). This diagram should present a deeper understanding of the problem. Each diagram that you have done so far should shed more light on the problem and improve your understanding of the problem. Explain your assumptions and reasons for the diagram.

- a dynamic model of classes with significant dynamic behavior. Your report should contain the following:

  1. a description of normal scenarios for your system (page 171, Figure 8.15). These scenarios should represent normal conditions for the system. Explain your assumptions and reasons for selecting and using such scenarios.
  2. a description of exception scenarios for your system (page 171, Figure 8.16). These scenarios should represent exceptional conditions for the system. Explain your assumptions and reasons for selecting and using such scenarios.
  3. an event trace for the scenarios described before (page 174, Figure 8.18). This diagram should show the classes that are involved in the scenario and the events that are sent to each class. Explain your assumptions and reasons for the diagram.
  4. dynamic models of the classes with significant dynamic behavior (page 176, Figure 8.20). These dynamic models can go as deep as you want (page 100, Figure 5.18; page 107, Figure 5.23; page 108, Figure 5.24; and page 109, Figure 5.25). However, they should be explanatory of what is going on in the system. Explain your assumptions and reasons for the diagram.

- a functional model and function flowchart of classes that serve as interface between the system and the outside world. Your report should contain the following:

  1. an input and output data flow as well as a flow chart for the system (page 180, Figure 8.23). Explain your assumptions and reasons for the diagrams.
  2. functional models and function flowcharts of the classes (page 181, Figure 8.24 and Figure 8.25). These functional models and flowcharts can go as deep as you want (page 134, Figure 6.10; page 135, Figure 6.11; and page 136, Figure 6.12). However, they should be explanatory of what is going on in the system. Explain your assumptions and reasons for the diagram.
  3. a description of the main functions used in the functional model and flowcharts (page 183, Figure 8.26). These functional description can be in natural language, mathematical models (See the Numerical Methods section of the class - Ayyub and McCuen), and pseudocode. Explain your assumptions and reasons for your description.

NOTE: These models and descriptions are preliminary and will be rough. However, do your best to get them as refined as possible and as time permits. The use of 2 models in this part is to give you the choice to change your system later if you have any problem modeling it. In this way, you will be able to finish your project on time and have fun.

PART 3:
(OMT Models for 1 System)

By this part, your group has 2 engineering systems with OMT models. Of those 2, your group should select 1 and prepare the following:

- a more elaborated description of the engineering system (3-5 pages). This description will take in consideration all you have learned about your system from the development of your OMT models. Explain your assumptions and reasons for the description.
- a more elaborated object model. This object model will take in consideration all you have learned about your system from the development of your previous OMT models. Make use of inheritance, qualifiers, roles, and associations. Explain your assumptions and reasons for the description.
- a more elaborated dynamic model of classes with significant dynamic behavior. This dynamic model will take in consideration all you have learned about your system from the development of your previous OMT models. Make use of layered states diagrams. Explain your assumptions and reasons for the diagram.
- a more elaborated functional model and function flowchart of classes that serve as interface between the system and the outside world. This functional model and function flowchart will take in consideration all you have learned about your system from the development of your previous OMT models. Make use of layered functional diagrams. Explain your assumptions and reasons for the diagram.
- a detail description of the program that is going to implement the model. This description has to be in mathematical form (if your system needs it) and/or pseudocode. Go into as much detail as you possibly can. Explain your assumptions and reasons for the description.

NOTE: These models and descriptions are refined version of the original models and should represent the actual structure and behavior of the engineering system you want to model. By this time, you have committed to one model. This assumes that part 2 helped you to discriminate against a system that will be too difficult to implement. In addition, this part will help you to plan your code before the project is due. In that case, you will not be rushing to the end.

FINAL:
(OMT Models and Running Program for 1 System)

By this part, your group has refined the model of your system to a detail that only needs implementation. Thus, for the final part of the project your group should prepare the following:

- a full description of your system (5-10 pages). It should explain what are the inputs, how it works and what is the output. In this description, you should submit better refined object, dynamic and functional models as well as description of important functions and functions flowchart.

- a working program that incorporates your model; it has the structure of the system that you want to simulate as well as it behaves as that system would behave. You should submit a hard copy and an electronic copy of your code, with comments and a manual of instruction on how to use your program.

NOTE: Some of you will like to work within a graphical environment for your program. This is not required and it will not add points to your project. This will involve a lot of work. So, if you don't have the time don't even get involved, use regular console and file input and output.

GOOD LUCK

STUDENT INPUT

Don't sign this page and leave it apart from your problem set. This is a feedback mechanism that we use to evaluate the problem sets and the lectures. If you don't want to write a comment please give a rate from 1 to 5 with 5 being the highest.

1. How many hours did you spend doing part 2?
2. How relevant were the concepts discussed in class for part 2?
3. How were the lectures (were they helpful?), are the notes any useful?
4. How was the instructor (was he helpful?)?
5. Does the instructor come prepared to classes?
6. Is the instructor knowledgeable in the subject?
7. Does the instructor explain things clearly?
8. Is the instructor responsive to your needs (make you comfortable asking questions)?
9. Does the instructor motivate you (make the subject interesting)?
10. Does the instructor facilitate participation?
11. How was the TA (was he helpful? all the questions for the instructor also apply for the TA)?
12. Do you have any problem understanding the instructor or the TA?
13. Do you like the dynamics of the class?
14. What things would you like to change in the class or the project?
15. Is the class meeting your expectations?
16. Any other comments, i.e. how are the books?

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1. How many hours did you spend doing part 3?
2. How relevant were the concepts discussed in class for part 3?
3. How were the lectures (were they helpful?), are the notes any useful?
4. How was the instructor (was he helpful?)?
5. Does the instructor come prepared to classes?
6. Is the instructor knowledgeable in the subject?
7. Does the instructor explain things clearly?
8. Is the instructor responsive to your needs (make you comfortable asking questions)?
9. Does the instructor motivate you (make the subject interesting)?
10. Does the instructor facilitate participation?
11. How was the TA (was he helpful? all the questions for the instructor also apply for the TA)?
12. Do you have any problem understanding the instructor or the TA?
13. Do you like the dynamics of the class?
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16. Any other comments, i.e. how are the books?

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1. How many hours did you spend doing the final part of the project?
2. How relevant were the concepts discussed in class for the project?
3. How were the lectures (were they helpful?), are the notes any useful?
4. How was the instructor (was he helpful?)?
5. Does the instructor come prepared to classes?
6. Is the instructor knowledgeable in the subject?
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