Software Modeling and Design

3700.002

Spring 2020

Solutions for Homework #3

Due: March 02, 2020 11:59PM (Monday)

Maximum points: 100

(Individual Assignment)

Note: Submit a single pdf document with solutions to all the questions. Embed all diagrams and text in the word document and create the pdf. Use the tool of your choice to generate UML diagrams. Possible options are PlantUML, ARGOUML, Visio, Word, or any other UML development tool.

Q1: (10 Points): Problem 12.3 from textbook page number 208.

The following tentative classes should be eliminated.

- **Redundant classes**. SelectedObject, SelectedLine, SelectedBox, SelectedText (redundant with Selection), Connection (redundant with Link).
- **Irrelevant classes**. Computer (it is implicit that we are developing a model for the purpose of computer implementation).
- **Vague classes**. GraphicsObject (not sure precisely what this is; we do not need it as we have more specific classes).
- **Attributes**. position, length, width, fileName, lineSegmentCoordinate, name, origin, scaleFactor.
- **Implementation constructs**. x-coordinate, y-coordinate (what about polar coordinates?, also they are really attributes), Menu (but you could argue about whether Menu should be a class), Mouse, Button, Popup, MenuItem (a manner of implementing menus), CornerPoint, EndPoint (there are other ways to specify a Box), Character (an implementation construct for Text).

After eliminating improper classes, we are left with Line, Link, Collection, Selection, Drawing, DrawingFile, Sheet, Point, Box, Buffer, and Text.

Q2: (10 Points): Problem 12.5 from textbook page number 208.

The following tentative associations should be eliminated because they are between eliminated classes:

- A box has a position. (Position is an attribute that has been eliminated. Replace by a box has a point.)
- A character string has a location. (Location is an attribute. We are using the term text and not character string.)
- A line has length. (Length is an attribute that has been eliminated.)
- A line is a graphical object. (For this problem, we do not consider GraphicalObject as a class worth modeling.)
- A point is a graphical object. (For this problem, we do not consider GraphicalObject as a class worth modeling.)
- A point has an x-coordinate. (X-coordinate is an attribute that has been eliminated.)
- A point has a y-coordinate. (Y-coordinate is an attribute that has been eliminated.)

The following tentative associations are irrelevant or implementation artifacts:

- A character string has characters. (This is not important enough to include in the model.)
- A box has a character string. (This is the same as a box has text.)

The following tentative associations are actions:

- A box is moved.
- A link is deleted.
- A line is moved.

The following associations are derived:

- A link has points.
- A link is defined by a sequence of points. (Replace by a link corresponds to one or more lines.)

The following associations were missing from the list given in the exercise:

- A drawing has one or more sheets.
- A drawing is stored in a drawing file.

We are left with the following correct associations and generalizations:

- A box has a point
- A box has text
- A link logically associates two boxes
- A link corresponds to one or more lines
- A selection or a buffer or a sheet is a collection

- A collection is composed of links and boxes
- A line has two points
- A drawing has one or more sheets
- A drawing is stored in a drawing file.

Q3: (15 Points): Problem 12.8 from textbook page number 209.

The following classes require state diagrams: Buffer and Selection.

The **Buffer** is used for copy, cut, and paste operations. The state of the buffer is simple: either it is empty, or it is full.

The **Selection** state diagram indicates whether one or more objects are selected. Thus, there are two states: Something selected and Nothing selected. The class model contains important information for the Something selected state: precisely which boxes and links are selected. The pick operation would need to distinguish between picking the first object selected and picking subsequent objects.

Q4: (10 Points): Problem 13.7 from textbook page number 238.

The application is a simple editor that supports only boxes, links, and text. Text is allowed only in boxes and the text size and font is fixed. Boxes automatically adjust to fit the enclosed text. Links consist solely of horizontal and vertical lines.

Q5a: (5 Points): Problem 13.8 from textbook page number 238.

Actors are the user and the file system.

Q5b: (10 Points): Problem 13.9 from textbook page number 238.

Use cases represent a kind of service that the system provides and should be at the same level of detail. Consequently, the use cases should not reflect detailed operations, but instead should focus on high level tasks that the user can perform. Here are the use cases. Figure below shows a use case diagram.

- Create drawing. Start a new, empty drawing in memory and overwrite any prior contents. Have the user confirm, if there is a prior drawing that has not been saved.
- Modify drawing. Change the contents of the drawing that is loaded into memory.
- Save to file. Save the drawing in memory to a file.

- Load from file. Read a file and load a drawing into memory overwriting any prior contents. Have the user confirm, if there is a prior drawing that has not been saved.
- Quit drawing. Abort the changes to a drawing and clear the contents of memory.

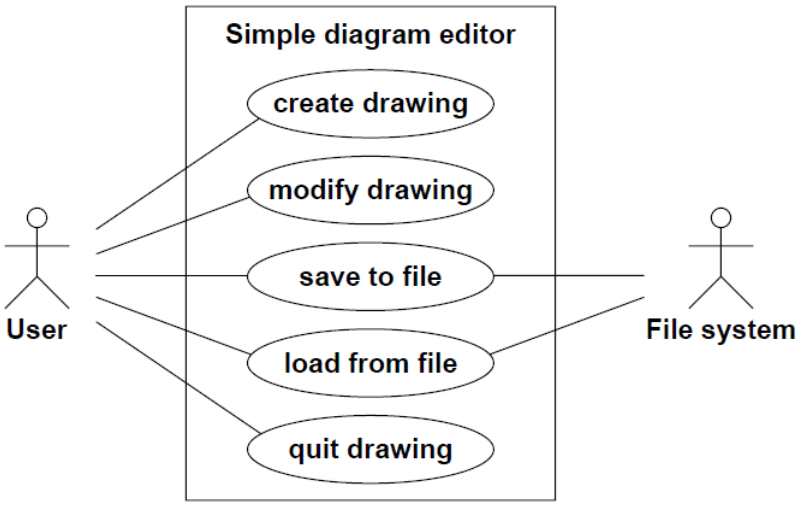
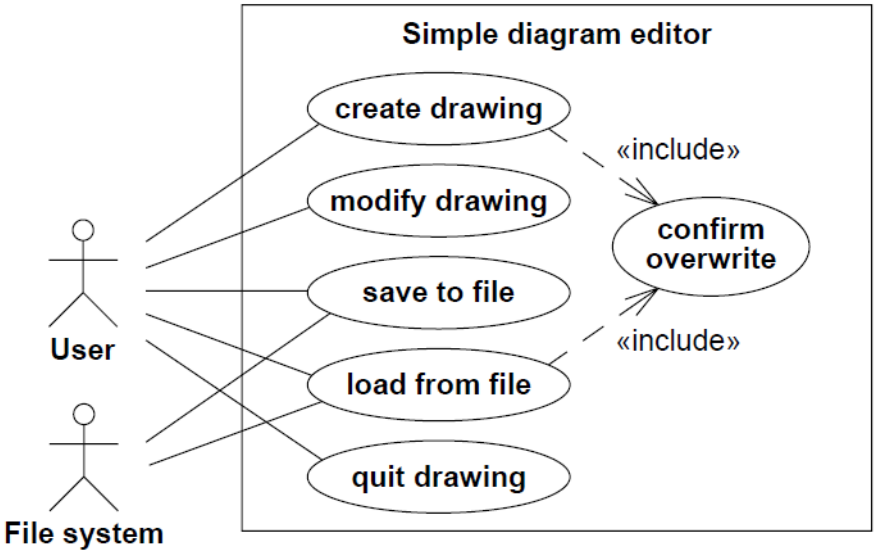


Figure A13.9 Use case diagram for the simple diagram editor

Q6: (10 Points): Problem 13.10 from textbook page number 238.

Figure below organizes the use cases. The overwrite confirmation is another use case that is included in creating a drawing and loading from a file.



Q7: (10 Points): Problem 13.11 from textbook page number 238.

There are an infinite number of correct answers to this exercise, one of which is listed below.

User loads an existing drawing. Editor retrieves the document and sets the cursor to the last referenced sheet. User goes to the first sheet. Editor moves the cursor. User goes to the next sheet. Editor moves the cursor. User deletes this sheet. Editor requests confirmation. User confirms. User goes to the last sheet. Editor moves the cursor. User goes to the previous sheet. Editor moves the cursor. User deletes all existing sheets. Editor requests confirmation. User confirms. User creates a new sheet. Editor sets the cursor to this sheet. User creates a box. Editor highlights newly created box. User enters text “x”. User copies x-box. Editor highlights new copy of box. User moves selected box. User selects text in box. Editor highlights text and unhighlights box. User cuts text. User selects empty box. Editor highlights empty box. User enters text “y”. User copies y-box. Editor highlights new copy of box. User moves selected box. User edits the “y” and changes it to “+”. User selects y-box. Editor highlights y-box. User copies y-box. Editor highlights new copy of box. User moves selected box. User edits “y” and changes it to “x+y”. User cuts x+y-box. User changes his/her mind and pastes the x+y-box back in. User selects the x-box. Editor highlights x-box. User also selects the +-box. Editor also highlights +-box. User links the boxes. User selects the y-box. Editor highlights y-box. User also selects the +-box. Editor also highlights +-box. User links the boxes. User selects the +-box. Editor highlights +-box. User also selects the x+y-box. Editor also highlights x+y-box. User links the boxes. User selects all boxes and links. Editor highlights all boxes and links. User groups the selections. User aligns the grouped selection with regard to the left-right center of the page. User renames the drawing file and saves the drawing.

Q8: (10 Points): Problem 13.12 from textbook page number 238.

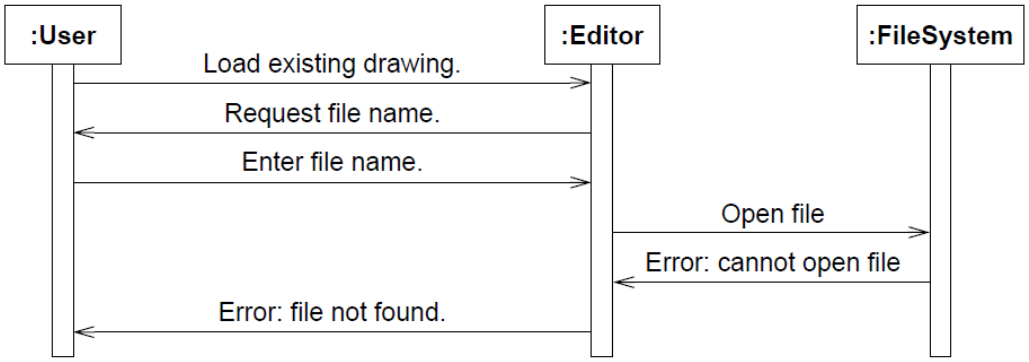
Error scenario 1: User enters command: load existing drawing file and supplies a file name. Command fails: file not found.

Error scenario 2: User selects the x-box. Editor highlights x-box. User also selects the y-box. Editor also highlights y-box. User also selects the +-box. Editor also highlights +-box. User tries to select the link box command. Command fails: must pick exactly two boxes for linking.

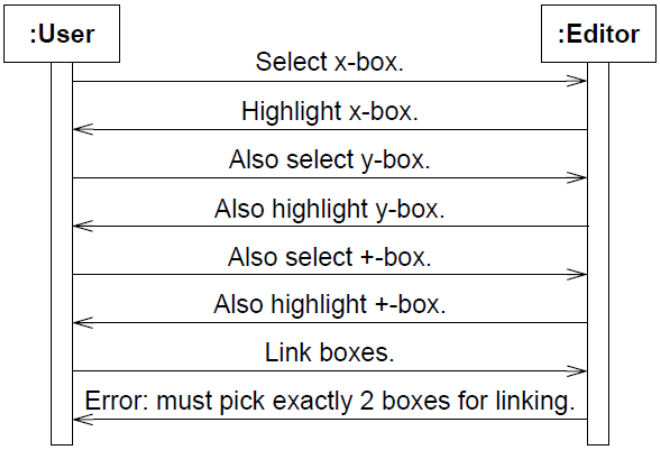
Error scenario 3: User selects the x-box. Editor highlights x-box. User tries to select the enter text command. Command fails: box already has text.

Q9: (10 Points): Problem 13.13 from textbook page number 238.

Sequence diagram for error scenario 1:



Sequence diagram for error scenario 2:



Sequence diagram for error scenario 3: