Solutions to selected problems of Homework 3

Problem 1 The following figure shows a portion of an object diagram for a computer system for laying out a newspaper. The system handles several pages which may contain, among other things, columns of text. The user may

- edit the width and length of a column of the text,
- move a column around on a page,
- move a column from one page to another

A column is displayed on exactly one page.

It is desired to modify the system so that portions of the same column appear on more than one page. If the user edits the text on one page, the edits should appear automatically on other pages.

Modify the object diagram above to handle this enhancement. *(Hint: since a column can be spread between various pages, it must know about it’s location at all of the pages that it appears in)*

Solution: See diagram on the next page:

Comments:

To allow a Column of text to be spread over several pages I added a ColumnWindow class which represents a rectangular area on a page.

A Page contains a number of ColumnWindows and a Column is laid out in possibly more than one ColumnWindow. (Note here that a Column object represents a piece of text rather than a rectangular object.)

Each ColumnWindow object needs to know its location and dimensions as well as the Page that it belongs to and the Column that it displays. To implement required functions each ColumnWindow must be able to Resize itself, MoveTo a different location on a page and MoveTo(another)Page.

Each Column is associated with a set of Lines of text and must be able to return the text that is displayed on a particular page, or, more precisely in a particular ColumnWindow (since there are possibly more that one ColumnWindows on a Page that display parts of the same Column). TextInColumnWindow service implements that function.

Each Column must also be able to Print itself.

This diagram is still not complete – for instance, it lacks message connections between objects that implement system scenarios. We’ll learn about message connections in the next few lectures.
**Problem 3** A simple digital watch has a display and two buttons to set it, the A button and the B button. The watch has two modes of operation, display time and set time. In the display time mode, hours and minutes are displayed, separated by a flashing colon. The set time mode has two sub modes, set hours and set minutes. The A button is used to select modes. Each time it is the mode advances in the sequence: display, set hours, set minutes, display, etc. Within the sub modes, the B button is used to advance the hours or minutes once each time it is pressed. Buttons must be released before they can generate another event.

Prepare a Object model of the watch. Identify attributes and services necessary to implement the described functionality.

**Solution:**

![Class diagram for a digital watch](diagram.png)
Comments:

Attribute **mode** of the **DigitalWatch** Class could have one of the following set of values: \{displayTime, setHours, setMinutes\}

Attribute **status** of the Button class is either one of two values: \{pressed, released\}.

**ButtonA** and **ButtonB** classes override the Press and Release methods of the **Button** Class, as Press/Release of **ButtonA** results in a different event from Press/Release of **ButtonB**

This incomplete diagram does not show any message connection and complete specifications of the Class Services, and thus it is, for example, unclear what each Press method is doing and how the time value advances when appropriate buttons are pressed.