

University of Toronto**Faculty of Arts and Science at Erindale
Department of Computer Science****CSC340S - Information Systems Analysis and Design**

Spring 2002

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April-May Examination**No Aids Allowed
Duration: 2 hours****Make sure that your examination booklet has 6 two sided pages
(including this one). Write your answers in the space provided.****This examination counts for 35% of your final mark.****Name:**

*(Please underline your last name)***Student Number:****Question Marks**

1. _____/20 2. _____/10

3. _____/15 4. _____/10

5. _____/10 6. _____/10

7. _____/30

Total _____/105

1. [Class Diagrams, Design Patterns; 20 marks]

In the space below

- a) Draw the class diagram for the classes on the following page (AODigit, OEnd, ODigit, OVisitor).
- b) Identify a major piece of your diagram that is indicative of the use of the Component pattern.
- c) Identify a major piece of your diagram that is indicative of the use of the Visitor pattern.

1. [Class Diagrams, Design Patterns (continued);]

- d) Write class ODecrement (an OVisitor). If an instance of ODecrement visits an odometer, then the odometer will read one kilometer less than it did before the instance visited. For example, if an odometer reads 002 then after 4 visits by an instance of ODecrement, the odometer will read 998. *Finally*, add ODecrement to your class diagram above.

```
public abstract class AODigit {
    public abstract AODigit getNext();
    public abstract int getDigit();
    public abstract void setDigit(int s);
    public abstract void accept(OVisitor ov);
}
public class OEnd extends AODigit {
    public AODigit getNext() { return(null); }
    public int getDigit(){ return(0); }
    public void setDigit(int s){ }
    public void accept(OVisitor ov){ ov.visit(this); }
    public OEnd(){ }
}
public class ODigit extends AODigit {
    private int digit;
    private AODigit next;

    public AODigit getNext(){ return(next); }
    public int getDigit(){ return(digit); }
    public void setDigit(int s){ digit=s; }
    public void accept(OVisitor ov){ ov.visit(this); }
    ODigit(AODigit next){
        this.next=next;
        digit=0;
    }
}
public interface OVisitor {
    public void visit(ODigit d);
    public void visit(OEnd e);
}
```

2. [Activity Diagrams; 10 marks]

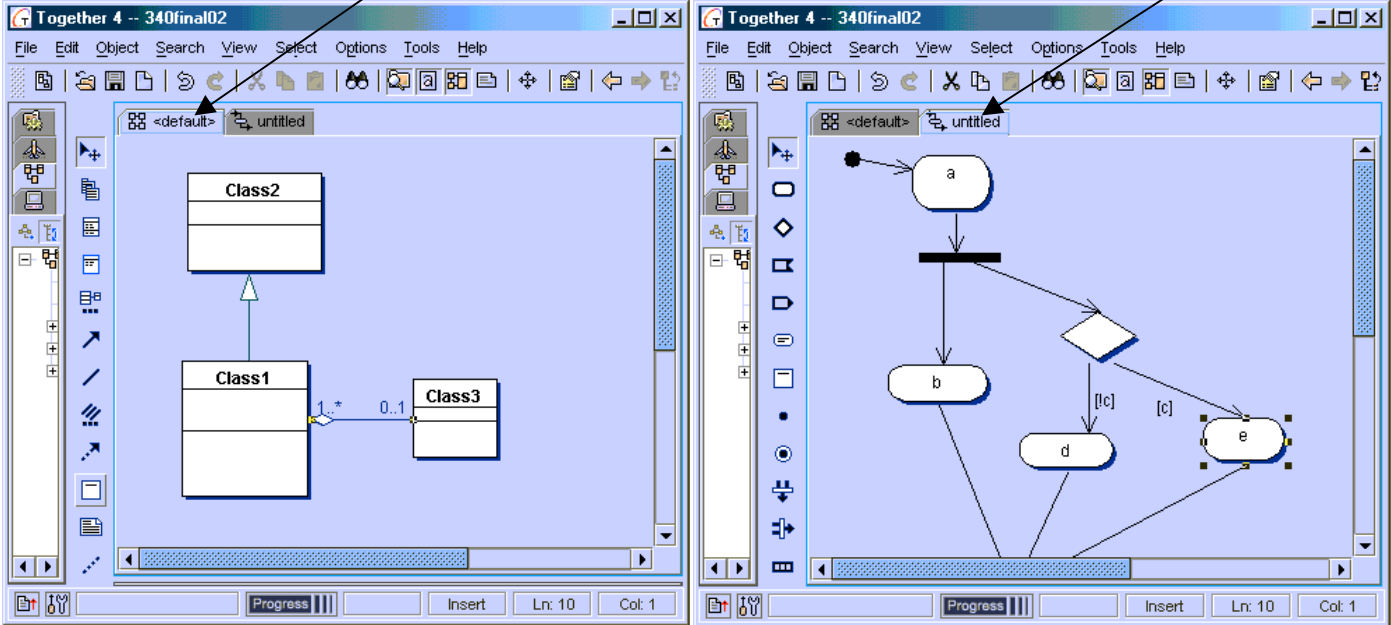
Draw *activity diagrams* for the following two construction companies processes.

Construction company A builds houses by first building the foundation, then framing them, then wiring and finally drywalling. For A, wiring consists of first wiring the phone (with the possibility of wiring 2 lines if necessary) then wiring the electrical and finally the ethernet.

Construction company B builds houses by first building the foundation, then framing them, then wiring and finally drywalling. For B, wiring the phone, electrical and ethernet can occur simultaneously, but all must be completed before the drywalling begins. Here again, a second phone line will be wired if necessary.

3. [Human-Computer Interaction; 15 marks]

The following two snapshots show the use Together makes of the tabbed control. For each feature below, *explain* whether or not Together's use of the tabbed control exemplifies a good use of the feature. Clicking on the left tab (<default>) causes the class diagram to appear. Clicking on the right tab (untitled) causes the activity diagram to appear. Note, these clicks cause other things to happen as well.



Affordance:

Mappings:

Feedback:

Mental Model:

Forcing Functions:

Automatic Learning:

4. [Hardware Selection; 10 marks] Give an example (Hardware and/or Software) of each of the following. For each example argue briefly that it is an example of the term.

Black Box System:

Glass Box System:

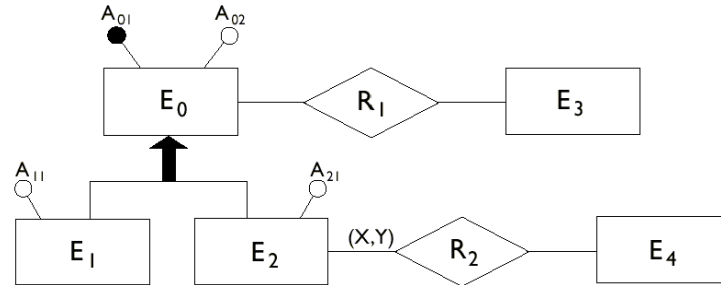
Open System:

Proprietary System:

5. [ER Diagrams; 10 marks] Draw an ER diagram for the following scenario. Make sure you identify entities, relations, keys (internal and external identifiers), composite attributes, generalizations, relation and attribute cardinalities etc.

A corporation consists of a collection of departments. Each department has a name as well as one or more phone numbers. Employees working for the corporation are identified by their employee code and have a name, salary and age. Each department is made up of a collection of one or more employees and is managed by exactly one employee. Each employee is part of at most one department (and so can manage at most one department). The corporation tracks the date at which an employee joined a department. Employees can work on any number of projects. Again, the corporation tracks the date each employee began working on each of their projects. Each project is identified by its name and has a budget. Each project optionally has a completion date and at least one employee working on it. The corporation has many branches, but only one branch in any given city. Information kept on each branch includes its city, street number, street and postal code. Each department is identified by its name as well as the city (ie branch) it resides in. For example the Accounting department in Toronto is considered a different department from the Accounting department in Vancouver. A single branch can be the location of many departments.

6. [Database Design; 10 marks] Convert the following ER schema into one that does not use generalization. Do this in two ways. For each conversion, state when this conversion is appropriate (for example: some conversions may be appropriate only when the generalization is total (every E0 is either an E1 or E2)).



7. [Short Questions; 30 marks total]

[Software Lifecycles; 5 marks] Describe the prototyping software lifecycle (a nicely labeled picture is sufficient).

[Design Patterns; 5 marks] Describe what a Design Pattern is and state two main reasons for using them.

[Database Design; 5 marks] Consider a relation $R(\underline{A}, B, C, D, E, F)$ with primary key A, B and additional functional dependencies $A, C \rightarrow D$ and $A, C \rightarrow E$ and $D \rightarrow E$ and $B \rightarrow F$. Place this relation in 3NF, or explain why it is already in 3NF. Note: $A, C \rightarrow D$ means that A and C together determine D .

7. [Short Questions (continued); 30]**[Software Architectures; 5 marks]** Consider the broker software architecture for distributed systems.

Describe what it is:

Pros:

Cons:

[State Transition Diagrams; 5 marks] Give a state transition diagram (STD) which accepts input strings consisting of “0”s and “1”s , ending with the special character “\$” and such that the output of the STD is:

- “YES” if the input is a string of the form “01\$”, “0101\$”, ... , “01 (n times) \$”
- “NO” for all other input strings.

[Decision Trees; 5 marks] Draw a **decision tree** for the following decision procedure for travelling to a place X: “If the place you are travelling to is within 150km, take your car; if the place is between 150km and 600km, take a train if the travel is for a holiday, and a plane otherwise; for travel over 600km take a plane”.

[Scratch paper]

[Scratch paper]