Your name: _____

CS361 Fall 2014 Midterm

Print out this midterm exam, fill it out, and bring your completed exam with you to class at 4pm on Tuesday Nov 25. Late submissions will be penalized. (Unlike your other homework, do not submit this exam electronically.) This exam should take no more than 2 hours to complete (averaging approximately 15 minutes per problem), but you are welcome to spend as much time as you like, as long as you submit it on time.

This is an open-book exam. You may use notes, refer to the lecture slides, and/or rely on other sources of written material, as long as that material is not derived from the knowledge or assistance of any classmate obtained after this exam is distributed. In other words, work individually. Any collaboration or discussion will be considered cheating.

The rules regarding Academic Dishonesty will be strictly enforced. Note that the penalties are quite severe and that the instructor has no discretion once a case of cheating is detected. Please see the OSU web-page for more details (http://oregonstate.edu/studentconduct/achon.htm).

Question	Possible Points	Points Scored
1 – choosing process	10	
2 – quality attributes	10	
3 – class diagram	20	
4 – design patterns	15	
5 – implementation design	10	
6 – sequence diagram	15	
7 – effort estimation	10	
8 – scheduling	10	
	100	

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Question 1 (10pts): Suppose that the New York Times wants to hire you to build a system for tracking what their website and their competitors' websites look like. They'd like you to start by just creating a *simple* little desktop application that runs once per day at noon. This application will call 3 specific websites via http and store the HTML of each website's home page on a hard drive. Then, a few months after this program is done, they will want you to *expand* the system by adding some other small programs for analyzing the HTML that has been collected.

1a) Would you use an *iterative* or an *incremental* process for building this system, and *why*?

1b) Suppose that your boss wanted to use a *waterfall* process for this project. Name one good reason why a sensible software engineer would suggest that this is not an appropriate process to use for this project.

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Question 2 (10pts): Your customer tells you a lot about the system, including these statements:

1. "The program has to be really easy to understand and use."
2. "The program has to be very fast because we might want to run it a lot more than once per day."
3. "It needs to be easy to change the code so that we can add new features some day."
4. "The system should be able to communicate with websites via https, http 1.0, or http 1.1."
5. "At some point in the future, we might want to take some pieces of this system and use them as pieces of new systems."

Each of those statements above is related to a quality attribute. Based on the five statements above, which *five of the ten* quality attributes shown below are probably most important for this system?

	Yes	**No**
Reliability		
Efficiency		
Integrity		
Usability		
Maintainability		
Testability		
Flexibility		
Portability		
Reusability		
Interoperability		

(Check "Yes" for 5 quality attributes and "No" for 5 quality attributes)

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Question 3 (20pts): Several months after you release the initial version of the program for the New York Times, they decide that it's now time to extend the system. Suppose that the key entities in the system are *sites*, *pages*, and *screenshots*. Each site has one or more pages; each page has exactly one site. Each page has one or more screenshots; each screenshot belongs to exactly one page. Each site has a domain name and its list of pages. Each page has its site, a URL, and its list of screenshots. Each screenshot has its page, its date of retrieval, its time of retrieval, and its HTML content.

Draw a UML class diagram showing these entities, their relationships, and their attributes. Remember to show cardinality on relationships. You do not need to show the types for attributes. You do not need to show a system boundary.

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Question 4 (15pts): Suppose that you are building some other systems for some other customers. Which design pattern is most appropriate for each of the following situations?

5a) You need to call a subsystem using a long series of complex lines of code.

A. Builder
B. Façade
C. Memento
D. Factory

5b) Your code has to decide at runtime which class to instantiate.

A. Builder
B. Interpreter
C. Memento
D. Factory

5c) You code will need to save the state of an object and then reload it later.

A. Builder
B. Façade
C. Memento
D. Observer

5d) Your system will need to support scriptability

A. Builder
B. Interpreter
C. Memento
D. Factory

5e) You want to encapsulate the code for constructing and filling in a complex composite object.

A. Builder
B. Façade
C. Interpreter
D. Observer

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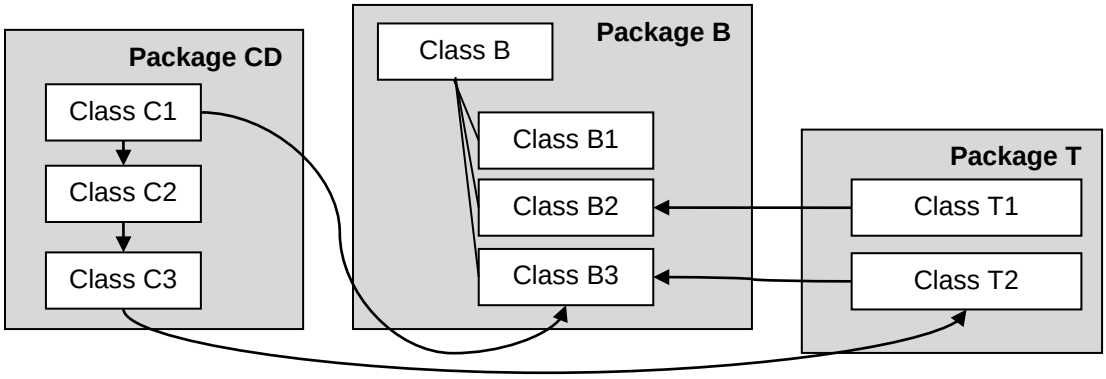
Question 5 (10pts): Consider the following design for implementing some system.



The concern of Package CD is to provide a user interface. The concern of B is to provide data management; B and its children form a Composite. The concern of T is to perform specialized analyses.

5a) What tip or technique is violated by the way in which classes in T reference classes in B?

A. Don't talk to strangers (Law of Demeter).
B. Split modules to reduce cycles.
C. In reuse, prefer composition over inheritance.
D. Use interfaces to declare promises.

5b) Classes C1 and T2 both write to class B3. What form of coupling do C1 and T2 have?

A. Stamp
B. Data
C. Common
D. Control

5c) At runtime, Class C1 performs part of a certain task and then passes control to Class C2. Class C2 performs a second step of the task and passes control to Class C3. Class C then performs the third and final step of the task. In other words, these three classes together perform a process. What form of cohesion do these three classes demonstrate?

A. Coincidental
B. Logical
C. Procedural
D. Communicational

5d) Recall that the concern of package CD is to provide a user interface. Suppose that it is very important that you get the colors and fonts correct when designing CD. Which of the following techniques would be most appropriate for achieving this?

A. Use lightweight prototyping
B. Use paper prototyping
C. Use manual analysis
D. Use formal analysis

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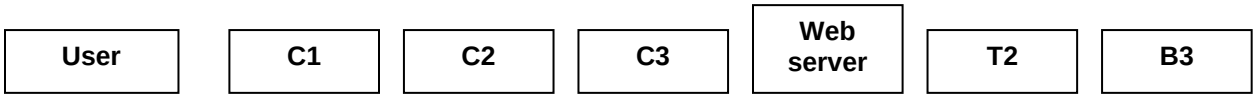
Question 6 (15pts): Here is how the system implements a use case:

Step 1. The user passes a URL to Class C1.
Step 2. Class C1 writes the URL to Class B3.
Step 3. Class C1 passes the URL to Class C2.
Step 4. Class C2 attempts to connect to the web server specified by the URL, in order to retrieve the HTML at that URL.
Step 5. If the web request fails (empty or null HTML is returned by the server), then Class C2 repeats Step 4 forever until it finally has retrieved the HTML.
Step 6. Now that HTML has been retrieved from the web server, Class C2 passes the HTML to Class C3.
Step 7. Class C3 does some cleanup on the HTML (like removing advertisements from the HTML) and then passes the cleaned HTML to Class T2.
Step 8. Class T2 writes the HTML to Class B3.

Complete the following message sequence diagram showing these events. Remember the life lines.



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Question 7 (10pts): The table below describes the complexity of each component package.

Package	This is a…
CD	Screen, difficult complexity
B	3GL component
T	3GL component

7a) How many application points does this system have, in total?

7b) Suppose that your team has *nominal experience and capability* with creating this kind of system, and your team has *nominal CASE maturity and capability*. What is the expected productivity of each team member, in application points per month?

7c) How many person-months would this system take to implement?

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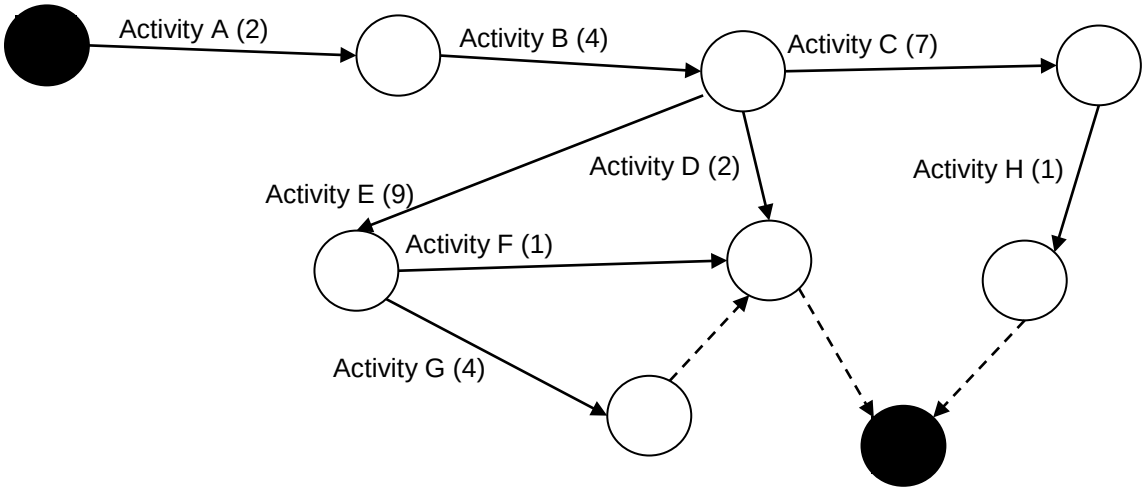
Question 8 (10pts): Suppose that your company builds a system by performing the activities shown in the graph below. All estimates of effort are shown in ***person-weeks***.



8a) What activities are on the critical path?

8b) What is the slack time for Activity D?

8c) What is the length of the critical path, in weeks?