**Advanced Web Development – Midterm (100 points)**

**Due date on blackboard. No late submissions will be graded.**

Instructions:

1. This is a take-home midterm. Please submit typed answers and computer generated diagrams through the blackboard, if you choose to include hand-drawn diagrams, then they should be neat, legible, and properly referenced in text.
2. If you have hand drawn diagrams then scan and email to me or give hardcopies to the department secretary by due date.
3. All work is to be done independently: you may not discuss any of the material with your classmates, friends, or colleagues.
4. You may use external references including web pages, research literature, and textbooks. However, you must indicate which resources you have consulted. If your answers make use of specific facts that you find in an external resource, please reference the resource. Don’t just copy from an external resource, use your own words. Any use of external resources without proper attributionwill be examined for signs of possible plagiarism. I take this very seriously.

Question 1 – Web application design (70%)

The aim of this question is to **design** **(not implement)** a web application (using Rails) to manage online testing and certifications (for an example see [www.brainbench.com](http://www.brainbench.com) – individual certification). The website will offer tests in various categories (e.g., information technology, aptitude, finance etc.) and under each category offer specific certification (e.g., Java certification under IT, problem solving under aptitude, etc.). The functionality provided by the website will include the following:

1. Users will be able to search for (using various criteria), register, login, and take tests.
2. Each test area (say Java) will lead to a certification (say Java certification) if the user passes the test.
3. The application **will store the results of all the tests that a user has taken and also store all the certifications that a user has received.**
4. Each **test result and certification can be marked as “public”** by the user so the world can see it.
5. Unregistered users (say employers) will be able to access the results of tests taken by a user and certifications received by entering a **PIN number provided by the user**. They can also provide the **user lastname and email to access all the results that the user has marked as “public**.”
6. The application will store a question bank for all the tests that it provides. There will be two question banks: **real and practice**. Each user should be able to take practice tests for any certification.
7. The application should maintain relevant statistics about usage: **how many tests have been taken, when, in what categories, etc.? How much time have users spent on each test?**
8. The questions, certifications, categories, users, and other pertinent data can be modified by administrators.

Answer the following based on the description above. Be as comprehensive as possible with the functionalities in mind. While designing, keep good design principles in mind with respect to the database, application structure (MVC etc.), and scalability. With each answer include a brief description whenever needed:

1. Provide all the models (in the Rails sense) that you will need to implement the above application. Include all attributes (table columns) that each model needs to have to implement the above functionality. (10 points)
2. Provide the relationships between all the models (using the has\_many, has\_one, belongs\_to, etc.). (10 points)
3. Provide a list of all the controllers that you might need for such an application. Please think about REST (each resource has one controller) principles here (10 points)
4. Provide the main functions/methods/actions for each controller that will be needed to implement the above functionality. (10 points)
5. Show the workflow through the system for the following scenarios (see example below): (30 points)
   1. User logs in
   2. User searches for tests to take
   3. User lists all the tests he/she took with a listing of certifications obtained.
   4. Employer searches for all the public tests and certifications for a user “Smith” with email address “smith@gmail.com.”
   5. Administrator wants to know how much total time the users have spent testing on the system.

Example using the Depot application: user adds item to cart

* User clicks button “add to cart” in the *index* view of *store* controller
* Button triggers method *add\_to\_cart* in *store* controller, passes the *product\_id*
* *add\_to\_cart* uses the *product* model to find the item to be added (by *product\_id*)
* the *add\_to\_cart* view shows the cart with the added product

The above example is in prose, you can use also an activity diagram to show the above if you wish. However, explicitly mention all the models, views, and controller methods being called, use swim lanes if necessary.

Question 2: Agile development (30%)

Your company got the contract to implement the web application you designed in Question 1. Write a short white paper aimed at convincing your managers and their bosses that your organization should adopt agile development methods. Describe what those methods are, how they can help, and what should be done to implement them. Compare them to other methods of development and how they may or may not work for the above work in Question 1. As your management is very cost-sensitive, they may be worried that agile development would increase software development costs: how would you convince them that this is not a problem? Use the papers discussed in class and any others if needed with references. Your management has a short attention span, your job is to explain agile development and convince your management as best as you can in *two* pages (double-spaced). *Please write in your own words, cite all outside sources.*