Sample CS 142 Final Examination

Winter Quarter 2016

You have 3 hours (180 minutes) for this examination; the number of points for each question indicates roughly how many minutes you should spend on that question. Make sure you print your name and sign the Honor Code below. During the examination you may consult two double-sided pages of notes; all other sources of information, including laptops, cell phones, etc. are prohibited.

I acknowledge and accept the Stanford University Honor Code. I have neither given nor received aid in answering the questions on this examination.

_____
(Signature)

_____
 (Print your name, legibly!)

_____
(SUID - stanford email account for grading database key)

Problem	#1	#2	#3	#4	#5	#6	#7	#8	#9	
Score										
Max	12	12	8	10	10	8	8	8	12	

Problem	#10	#11	#12	#13	#14	#15	#16	#17	#18	Total
Score										
Max	12	8	8	12	8	10	12	8	14	180

Problem #1 (12 points)

A. (6 points) Explain why cloud computing platforms work well for web application startup companies that are starting small but hoping to make it big in a hurry.

B. (6 points) Explain why it is easier for a web application with many geographically distributed users to deliver read-only content such as images to its users' browsers than non-read-only content.

Problem #2 (12 points)

A. (7 points) Give an example of a denial of service attack that a user could do on your Project #8 photo sharing app and describe how you could change the app to defeat the attack.

B. (5 points) Explain why you should make a habit of looking at the URL bar of your browser when using a web application from a trusted site such as a bank. Describe what you are trying to detect.

Problem #3 (8 points)

When exploring the MongoDB objects of a photo app after a security penetration tester had been running on the system, you noticed several users were created with weird names like `{{1+1336}}`. Give an educated guess at what the security tester was doing by creating a user with weird name like this. Describe the security loophole and what the penetration tester was hoping to see if this loophole was present.

Problem #4 (10 points)

    A. (4 points) What is the difference between HTTP and HTTPS (one sentence)?

    B. (6 points) Describe how a web server can tell if an attacker in the browser has tampered with the session information stored in cookies it sends down to the browser.

Problem #5 (10 points)

A. (4 points) Explain why a web application coding standard might demand that the script tag for including JavaScript libraries look like: `<script src="/library.js">` instead of containing the full site information like: `<script src="http://www.site.com/library.js">`.

B. (6 points) Describe the mechanism used by a web application to prevent its session cookies from being used by a web application from a different company.

Problem #6 (8 points)

A. (4 points) Describe two different ways information such as parameters can be sent from the browser to a web server using a HTTP POST request.

B. (4 points) Describe how a browser decides how long it can cache a web page it fetched with a HTTP GET request.

Problem #7 (8 points)

In a MEAN stack applications state, what is the order that the Model, View, and Controller (MVC) components typically arrive at the browser? It is OK to answer that one or more of them arrive at the same time.

Problem #8 (8 points)

REST apis are frequently described as doing CRUD. What does CRUD mean in this context?

Problem #9 (12 points)

A. Explain how the node.js Buffer class avoids having to allocate in the JavaScript heap every byte of a file being fetched via an HTTP get request to a browser.

B. Explain why a JavaScript function that takes multiples seconds to compute (e.g. some cryptographic library functions) are problematic in a Node.js server. Describe the problem.

Problem #10 (12 points)

A student doing CS142 Project #6 wrote the below code and discovered it didn't work correctly. When the execution reached the block with "`Process newComments and send response`", it always found newComments to be an empty array. Describe why this is the cause and what the student should do to fix the problem.

```
var newComments = [];
async.each(photo.comments, function (com, done_callback) {
    com = JSON.parse(JSON.stringify(com));
    User.findOne({ id: com.user_id}, function (err, user) {
        com.user = JSON.parse(JSON.stringify(user));
        newComments.push(com);
    });
    done_callback(err);
}, function (err) {
    if (err) {
        // Do error response
    } else {
        // Process newComments and send response
    }
});
```

Problem #11 (8 points)

Give an example of functionality that is implemented using Express middleware. Briefly describe how this middleware works.

Problem #12 (8 points)

The definitions that the Mongoose system we used for the photo-share app looked much like an ORM (Object Relational Mapping) that was used in older frameworks like Rails. Explain why it would be incorrect to call the grouping of those definitions a ORM.

Problem #13 (12 points)

A. (6 points) Explain how indexes make database queries go faster.
B. (6 points) Describe the disadvantages of having indexes on every property of an commonly updated object.

Problem #14 (8 points)

Explain why we frequently end up validating input in a web app twice: once in browser and then again in the web server.

Problem #15 (10 points)

For each of the following web application security attacks, state if the focus of defeating the attack would be more on a the frontend (i.e. browser-side) or the backend (e.g. web server and storage system) . Justify your answer.

- A. CrossSite Request Forgery
- B. Cross Site Scripting Attack
- C. SQL Injection
- D. Phishing Attack
- E. Denial Of Service Attack

Problem #16 (12 points)

Browsers and web servers communicate using the HTTP protocol. Even though all HTTP communication follows a request-response pattern, information can be viewed as either being passed from the browser to the web server or passed from the web server to the browser. For example, the Angular photo sharing application you built in Project #8 and your webServer.js pass back and forth all the major components of the application including: Angular HTML templates, CSS style sheets, JavaScript libraries, model data, and Angular controllers. For each of these components state which **direction** (browser to web server or web server to browser) and which **HTTP method/verb** is used for the transfer. Note some the components are transferred in both directions so list both directions and HTTP methods.

    A. Angular HTML templates

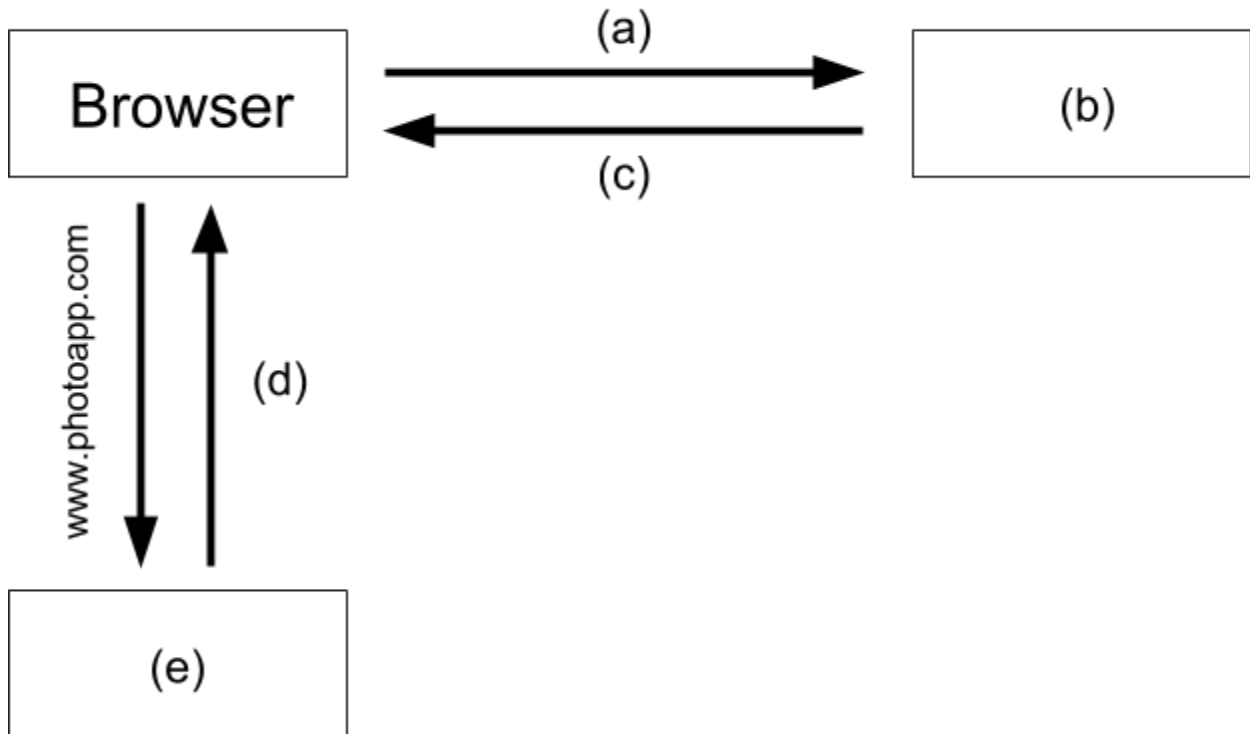   B. CSS style sheets

    C. JavaScript libraries

    D. Model data

    E. Angular controllers

Problem #17 (8 points)

A. (4 points) Explain what the pyramid of doom complaint is about Node.js and show an example of it.

B. (4 points) Explain why you typically don't see functions like sleep(10*1000); (sleeps for 10 seconds) in Node.js

Problem #18 (14 points)

1) This diagram outlines the process of displaying a web page when `www.photoapp.com` is typed into the location bar of the browser for the first time. For each of the letters in parentheses, select a value from the "Possible answers" section below that best describes the service or communication event the letter is marking.

   a)

   b)

   c)

   d)

   e)

2) Once the arrows are labeled, write down the order that these events (arrows only) happen when `www.photoapp.com` is typed into the browser.

   1.

   2.

   3.

   4.

Possible answers: browser, web server, storage server, memcache server, DNS server, HTTP GET request, HTTP POST request, HTTP GET response, HTTP POST response, database query request, database query response, memcache GET request, memcache GET response, DNS lookup, DNS response