Quiz 1
out of 97 points

Print your name on the line below.

Do not turn this page over until told by the staff to do so.

This quiz is "closed-book." However, you may utilize during the quiz one two-sided page (8.5" x 11") of notes, typed or written, and a pen or pencil, nothing else.

Scrap paper is included at this document's end.

Unless otherwise noted, you may call any functions we've encountered this term in code that you write. Unless otherwise noted, no more than two sentences are expected for short answers. If running short on time, you may resort to pseudocode for potential partial credit.

Circle your teaching fellow's name.

Alex Chang  
Alex Hugon  
Andrew Wang  
Ashin Shah  
Bannus Van der Kroot  
Bo Han  
Bob Kinney  
Cheng Huang  
Cragin Godley  
Dan Bradley  
Doug Lloyd  
Jack Greenberg  
Jason Hirschhorn  
Jenny Ye  
Jimmy Sun  
John Lee  
Jordan Jozwiak  
Joseph Ong  
Joshua Lee  
Julia Mitelman  
Julie Zhang  
Karen Xiao  
Kenny Yu  
Kevin Zhang  
Larry Ehrhardt  
Levi Roth  
Lexis Ross  
Marta Bralic  
Matthew Chartier  
Melissa Niu  
Michael Chen  
Michael Tingley  
Michelle Luo  
Naomi Bolotin  
Neal Wu  
Patrick Thornycroft  
Paul Bowden  
Paul Handorff  
Peter Hung  
R.J. Aquino  
Rob Bowden  
Sebastian Pierce-Durance  
Sophie Chang  
Steven Tricanowicz  
Tommy MacWilliam  
Tony Ho  
Travis Downs  
Vanessa Tan  
Wellie Chao  
Yacoub Kureh  
Zak Burke
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final score out of 97
Know Your Meme.

0. (0 points.) CIRCLE ALL THE BOWDENS.

True or False.

For each of the statements below, circle T if the statement is true or F if the statement is false.

1. T  T  (0 points.) David has Bowden Fever.
2. T  F  (1 point.) HTTP POSTs are more secure than HTTP GETs because the former are encrypted.
3. T  F  (1 point.) Whereas C programs can be executed at a command line, PHP programs must be executed by a web server.
4. T  F  (1 point.) HTML is a programming language, whereas CSS is not.
5. T  F  (1 point.) Huffman coding utilizes binary trees to compress ASCII files.
Attack!

6. (2 points.) How can a programmer minimize the probability of a buffer-overflow attack?

7. (2 points.) How can a user minimize the probability of a session-hijacking attack?

Passwords, etc.

8. (1 point.) Why should databases not store users' passwords in cleartext?

9. (2 points.) What's a one-way hash?

10. (2 points.) Suppose that one-way hashes of users' passwords are stored in some website's database rather than the passwords themselves. Explain the process by which the website can nonetheless authenticate a user upon submission of his or her password.
CS50 Stack.

Suppose that a stack for (non-negative) integers has been declared globally per the below, where CAPACITY is the maximum number of integers that can be in the stack, and size is the number of integers currently in the stack.

```c
struct
{
    int numbers[CAPACITY];
    int size;
}
stack;
```

Assume that stack has been initialized (e.g., in main) per the below.

```c
stack.size = 0;
```

11. (4 points.) Complete the implementation of pop, below, in such a way that the function pops (i.e., removes and returns) the int atop the stack. (To remove the int, it suffices to “forget” it; you needn’t overwrite its bits.) If stack is empty, pop should instead return −1.

```c
int
pop(void)
{
```

12. (4 points.) Complete the implementation of push, below, in such a way that the function pushes (i.e., adds) n on to the top of stack and then returns true. If stack is full or n is negative, push should instead return false.

```c
bool
push(int n)
{
```
13. (2 points.) Recall that a queue can be declared quite like a stack, with the addition of one field, head, that stores the index of the int at the head (i.e., front) of the queue, as in the below.

```c
struct
{
    int head;
    int numbers[CAPACITY];
    int size;
}
queue;
```

Why is head advantageous for queue but not for stack?

Trie these.

14. (2 points.) What's one advantage of using a trie to store a dictionary of English words?

15. (2 points.) What's one disadvantage of using a trie to store a dictionary of English words?
Design Decisions.

For each pair below, $x$ versus $y$, argue when you should use $x$ over $y$ (or, if you prefer, $y$ over $x$).

16.  (2 points.) $C$ versus $PHP$

17.  (2 points.) $JavaScript$ versus $PHP$

18.  (2 points.) $local$ $variable$ versus $global$ $variable$

O no, it's Omega again.

19.  (10 points.) Complete the table below by specifying lower ($\Omega$) and upper ($O$) bounds for each algorithm. Assume that each data structure already contains $n$ strings and that each string is of length no greater than some constant.

<table>
<thead>
<tr>
<th></th>
<th>lower ($\Omega$)</th>
<th>upper ($O$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>insertion into a hash table with separate chaining</td>
<td></td>
<td></td>
</tr>
<tr>
<td>insertion into a trie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>insertion into a sorted linked list</td>
<td></td>
<td></td>
</tr>
<tr>
<td>deletion from a sorted linked list</td>
<td></td>
<td></td>
</tr>
<tr>
<td>deletion from an unsorted linked list</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Too much to handle.

Consider the line of JavaScript code below, where `xhr` is an object of type `XMLHttpRequest` and `handler` is the name of a function defined elsewhere.

```javascript
xhr.onloadreadystatechange = handler;
```

20. (2 points.) In the context of Ajax, exactly what does this line of code do?

21. (2 points.) What would be the effect if we instead wrote that line with a pair of parentheses right after `handler`, as in the below?

```javascript
xhr.onloadreadystatechange = handler();
```

22. (3 points.) What are JavaScript, Ajax, and jQuery? Make clear how the three are related yet different.
Déjà Vu.

23.  (6 points.) Suppose that there are \( d \) days in a month and that you are given \( p \) pennies on the first day of that month, \( 2p \) additional pennies on the second day of that month, \( 4p \) additional pennies on the third day of that month, and so forth, with the daily number of pennies doubling each day up through the last day of that month.

Now consider the HTML form below.

```html
<form action="pennies.php" method="get">
  Days in month: <input name="d" type="text">
  <br>
  Pennies on first day: <input name="p" type="text">
  <br>
  <input type="submit" value="Calculate Total">
</form>
```

Complete the implementation of pennies.php below in such a way that the page calculates and displays the total amount that you will receive over the course of a month, expressed not as pennies but as dollars and cents (e.g., $21474836.47). Know that PHP comes with functions called printf and pow that behave just like their C cousins, but you're welcome to solve this problem without using either. You may assume that the user will submit an integer between 28 and 31, inclusive, for \( d \) and a positive integer for \( p \). You needn't worry about overflow. Take care to close any tags.

```php
<!DOCTYPE html>
<html>
  <head>
    <title>pennies</title>
  </head>
  <body>
    <?
```
Rapid Fire. (2 points each.)

24. What's octal notation?

25. What's an associative array?

26. If both foo.com and bar.com are hosted on the same server and resolve via DNS to the same IP address, how does that server distinguish requests for the former from requests for the latter?

27. What's an anonymous function?

Compare and Contrast.

Consider the two lines of code below.

```php
// first line
$s = htmlspecialchars($_POST["s"]);

// second line
$s = mysql_real_escape_string($_POST["s"]);
```

28. (2 points.) Compare the two lines of code: how are they similar?

29. (2 points.) Contrast the two lines of code: how are they different?
CS50 Queue.

Consider the MySQL table called questions below, used to keep track of questions at Office Hours.

<table>
<thead>
<tr>
<th>Column</th>
<th>Type</th>
<th>Attributes</th>
<th>Null</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>int(10)</td>
<td>unsigned</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>question</td>
<td>varchar(8192)</td>
<td>No</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>category</td>
<td>varchar(128)</td>
<td>No</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>student</td>
<td>varchar(128)</td>
<td>No</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>staff</td>
<td>varchar(128)</td>
<td>Yes</td>
<td>NULL</td>
<td></td>
</tr>
<tr>
<td>date</td>
<td>date</td>
<td>No</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>time</td>
<td>time</td>
<td>No</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

Suppose that each time a question is asked by a student at office hours, it's inserted as a row in this table, along with an autoincremented ID, the question's category, the student's username, and the day and time at which the question was asked. Once the student is paired with a staff member, that same row is updated with the staff member's username.

30. (3 points.) Which of this table's fields should be declared, if any, as a primary key? What would be the advantage, if any, of declaring it as such?

31. (2 points.) With what SQL query could you retrieve all rows for questions asked on Halloween this year (2011-10-31)?

32. (2 points.) Suppose that Tommy wishes to take credit for all questions ever answered by Matt. With what SQL query could Tommy replace all instances of Matt's username (chartier) in this table with his (tmacwill)?
The facebook.

33. (1 point.) Consider the HTTP request below.

GET /home.php HTTP/1.1
Host: facebook.com
User-Agent: Mozilla/5.0 (Windows; U; MSIE 9.0; Windows NT 9.0; en-US)
Connection: keep-alive

What URL do these headers suggest a user visited?

34. (2 points.) Consider the HTTP response below.

HTTP/1.1 301 Moved Permanently
Location: http://www.facebook.com/
Content-Type: text/html; charset=utf-8
Date: Wed, 16 Nov 2011 13:10:00 EST
Content-Length: 0

What effect do these headers have on a user's browser?

35. (2 points.) Consider the HTTP status code below.

403 Forbidden

Why might a server respond to an HTTP request with this status code?
HarvardCourses.

Suppose that courses.cs50.net responds to an HTTP request with the headers below.

HTTP/1.1 200 OK
Date: Wed, 16 Nov 2011 13:10:00 EST
Server: Apache
Set-Cookie: PHPSESSID=kh2mpljcarebrrpclamdths063; path=/
Content-Type: text/html; charset=UTF-8

36. (2 points.) What does it mean for a server to set a cookie, as via the headers above?

37. (3 points.) Explain in no more than one paragraph the relationship between PHPSESSID and PHP's $_SESSION.

Jason Encode.

38. (2 points.) Consider the PHP code below.

```php
<?
    $tf = array();
    $tf['name'] = "Jason";
    $tf['house'] = "Kirkland";
    print(json_encode($tf));
?>
```

Exactly what will this code output? You needn't pretty-print your answer.
**Sketchy Web Page.**

Consider the HTML below.

```html
<!DOCTYPE html>
<html>
<head>
  <title>Google</title>
</head>
<body>
  <form action="/search" method="get">
    <input name="q" type="text">
    <input type="submit" value="Google Search">
  </form>
</body>
</html>
```

39. (2 points.) If this HTML lives at `http://www.google.com/` and a user inputs `caterpillar` into the form, at what URL will David the user find himself upon submitting the form?

40. (2 points.) Complete the sketch of this HTML's DOM below. You may omit elements' attributes altogether.

[Diagram of DOM structure]

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Almost the End.

41. (6 points.) Consider the HTML form below via which users can subscribe to some website's mailing list.

```html
<!DOCTYPE html>
<html>
<head>
  <script>
    function f()
    {
    }
  </script>
  <title>subscribe</title>
</head>
<body>
  <form action="subscribe.php" method="post" name="s" onsubmit="return f();">
    Email Address: <input id="email" name="email" type="text">
    <br>
    Email Address (again): <input id="email2" name="email2" type="text">
    <br>
    <input type="submit" value="Subscribe">
  </form>
</body>
</html>
```

Complete the implementation of \( f \) above in such a way that this form will only be submitted to \( subscribe.php \) if the user has inputted identical values of non-zero length for both \( email \) and \( email2 \). You needn't check whether those values are syntactically valid email addresses. You needn't inform the user of any errors, as with \texttt{alert}. Assume that JavaScript is enabled in all users' browsers. You may \texttt{not} alter the HTML given or use jQuery.

42. (0 points.) What's the meaning of life?

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\[ \text{ ___ } \]

14 < 16
This is CS50 Scrap Paper.