

# Quiz 1

out of 97 points

Print your name on the line below.

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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" × 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.

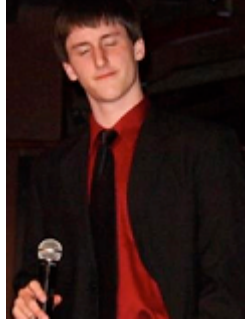
Alex Chang	Joseph Ong	Neal Wu
Alex Hugon	Joshua Lee	Patrick Thornycroft
Andrew Wang	Julia Mitelman	Paul Bowden
Ashin Shah	Julie Zhang	Paul Handorff
Bannus Van der Kloot	Karen Xiao	Peter Hung
Bo Han	Kenny Yu	R.J. Aquino
Bob Kinney	Kevin Zhang	Rob Bowden
Cheng Huang	Larry Ehrhardt	Sebastian Pierce-Durance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

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**Attack!**

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

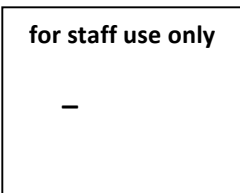
7. (2 points.) How can a user minimize the probability of a session-hijacking attack?

**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.

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

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

```
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`.

```
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`.

```
bool
push(int n)
{
```

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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.

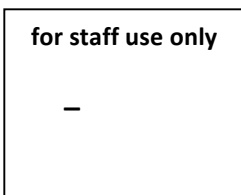
```
struct
{
    int head;
    int numbers[CAPACITY];
    int size;
}
queue;
```

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.

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

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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.

```
xhr.onreadystatechange = 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?

```
xhr.onreadystatechange = handler();
```

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

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## 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.

```
<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.

```
<!DOCTYPE html>

<html>
  <head>
    <title>pennies</title>
  </head>
  <body>
    <?
```

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**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.**

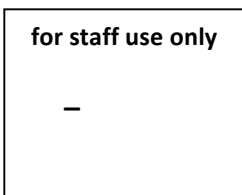
Consider the two lines of code below.

```
// 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.

Column	Type	Attributes	Null	Default
<code>id</code>	<code>int(10)</code>	UNSIGNED	No	<i>None</i>
<code>question</code>	<code>varchar(8192)</code>		No	<i>None</i>
<code>category</code>	<code>varchar(128)</code>		No	<i>None</i>
<code>student</code>	<code>varchar(128)</code>		No	<i>None</i>
<code>staff</code>	<code>varchar(128)</code>		Yes	<i>NULL</i>
<code>date</code>	<code>date</code>		No	<i>None</i>
<code>time</code>	<code>time</code>		No	<i>None</i>

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`)?

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**Thefacebook.**

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.

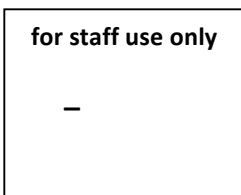
```
HTTP/1.1 301 Moved Permanently
Location: http://www.facebook.com/
Content-Type: text/html; charset=utf-8
Date: Wed, 16 Nov 2011 13:10:00 EST
Content-Length: 0
```

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.

```
<?
    $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.

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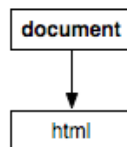
### Sketchy Web Page.

Consider the HTML below.

```
<!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.



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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.

```
<!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 `alert`. Assume that JavaScript is enabled in all users' browsers. You may not alter the HTML given or use jQuery.

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

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This is **CS50**.  
**Harvard College** Fall 2011

**This is CS50 Scrap Paper.**