Practice Quiz 1 - Answers

CS50 — Fall 2010

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Answers

1.
```
bool isEven(int x);
```

2.
```
bool isEven(int x) {
   return (x % 2) ? false : true;
}
```

3.
```
bool isEven(int *px) {
   return (*px % 2) ? false : true;
}
```

4.
```
#include <cs50.h>
#include <stdio.h>

int main(int argc, char **argv) {
   printf("Please input an integer: ");
   int x = GetInt();
   do {
      if(x % 2)
         printf("%d is odd.\n", x);
      else
         printf("%d is even.\n", x);
      printf("Please input an integer: \n");
      int x = GetInt();
   } while(x != 0);
   return 0;
}
```

5.
```
#include <cs50.h>
#include <stdio.h>
#include <ctype.h>

int main(int argc, char **argv) {
   if(argc != 2)
      return 1;
   int len = strlen(argv[1]);
   for(int i = 0; i < len; i++) {
      if(!isdigit(argv[1][i]))
         return 2;
   }
   int x = atoi(argv[1]);
   if(x % 2)
      printf("%d is odd.\n", x);
   else
      printf("%d is even.\n", x);
   return 0;
}
```

6. `The result is 16 and x is 10 here.`

7. Selection sort involves swapping the lowest remaining unsorted value with the value in the position immediately to the right of the highest sorted value. Insertion sort involves shifting the entire unsorted portion of the array to the right for the purpose of inserting the lowest remaining unsorted value into the position immediately to the right of the highest sorted value.

8.
```
Given key, array, and arraySize:
   Let first = 0 and last = arraySize-1;
   while first <= last:
      let middle = average(first, last);
      if array[middle] < key:
         last = middle-1;
      else if array[middle] > key:
         first = middle+1;
      else return true;
   return false;
```

9. 01001101

10. 00000010

11.
```
bool alphabeticalWord(char *s) {
   int len = strlen(s);
   if(s == NULL || len == 1)
      return true;
   char c = tolower(s[0]);
   for(int i = 1; i < len; i++) {
      if(c > tolower(s[i]))
         return false;
      c = tolower(s[i]);
   }
   return true;
}
```

12. Either 3 or 4, depending on implementation.

13. It simply prints the argument string passed to `mystery()`.

14. $O(n)$

15. It prints the argument string passed to `newMystery()` backwards.

16. Each pass of cocktail sort is really equivalent to two passes of bubble sort. Though in practice cocktail sort is faster as it stops the problem of "turtles", in the worst case, such as an array like [7,6,5,4,3,2,1], it will still be making n^2 swaps.

17.
```
int main(int argc, char *argv[]) {
   int count = 0;
   double f, sum = 0.00;
   while(f != SENTINEL) {
      sum += f;
      count++;
   }
   double avg = f / count;
   printf("%f is the average of the %d values you entered.", avg, count);
   return 0;
}
```

18. 5 2 1 6 7 3 4 8

19. 2 1 5 6 3 4 7 8

20. 1 2 5 3 4 6 7 8

21.
```
int nthFib(int n) {
   if(n <= 0)
      return 0;
   else if(n == 1)
      return 1;
   else
      return nthFib(n-1) + nthFib(n-2);
}
```

22. Infinite loops are loops that never terminate. Here are two:

```
for(;;);
while(1);
```

23. Yes, it will terminate. Eventually we will have so many copies of `anotherLevel()` frames running that we will run out of memory, and we will crash.

24. `gcc -o levels pilingUp.c`

25. logarithmic time

26. polynomial time

27. linearithmic (loglinear) time

28. `ptr = &i`

29. 2

30. `double *arr = (double *)malloc(40 * sizeof(double));`

31. k^n, where n is the length of the keyword

32. - `#define` should not have a semicolon
    - First `for` loop goes outside the bounds of the array
    - `j` is undeclared
    - No semicolon after the `malloc()`
    - The second `for` loop uses `i` where `j` is likely intended

33. ```
    typedef struct _cue {
       int enrolledStudents;
       char *prof;
       float cueRating;
    } cue;
    ```
    Declaring an instance of this structure would be as simple as `cue cs50;`

34. `x.prof`

35. `px->enrolledStudents` or `(*px).enrolledStudents`

36. A quick format will only delete the tables that describe where the data is, as an effort to save time. A complete format, however, will write over all of the data with random 1s and 0s, so the old data will be sufficiently removed, and you will not need to worry about the eBay buyer finding old credit card numbers (which they might have been able to do by scanning the disk, much in the same way you scanned the .raw file in PS5).

37. `FILE *infile=fopen("input.txt", "r");`

38. `FILE *outfile=fopen("output.txt", "wb");`

39. `unsigned char` or `char`

40. `typedef enum months {JAN,FEB,MAR,APR,MAY,JUN,JUL,AUG,SEP,OCT,NOV,DEC};`

41. 68

42. 7 coins: 1x100, 1x25, 1x10, 1x5, 3x1

43. 6 coins: 1x100, 2x20, 3x1

44. 5 coins: 1x150, 1x70, 3x2

45. 4 coins: 1x150, 1x50, 1x25, 1x1
    ```

46.
```
char *strncpy(char *dest, const char *src, int size) {
   if(dest == NULL)
      dest = (char *) malloc(sizeof(char) * (size+1));
   int len = strlen(src);
   for(int i = 0; i < len && i < size; i++)
      dest[i] = src[i];
   if(len >= size)
      return dest;
   for(int i = len; i < size; i++)
      dest[i] = '\0';
   return dest;
}
```

47.
```
#include <math.h>

bool isPrime(long long p) {
   if(n < 2)
      return false;

   // It can be proved that you only need to test through sqrt(p)
   for(long long factors = 2; factors < sqrt(p); factors++) {
      if(!(p % factors))
      return false;
   }
   return true;
}
```

48. Answer is on page 11 of this answer key.

49. We have direct and convenient lookup with an associative array. However, we cannot iterate numerically through an associative array using a for loop to print out the full contents.

50. The prefix property states that no encoding of a character may be a prefix to the encoding of another character. For example, an encoding where A = 1 and B = 10 is not immediately decodable, since the "1" in "10" could be a part of B, or a stand-alone A.

51. Open the files in each call for reading and writing, respectively.

52. `FILE` pointers

53. We are reading up to 1,000 characters at a time from the source file, and writing it to the destination file.

54. Now, we want to read from the destination file, as opposed to writing to it. Since our original handle was used to write, we need to close and reopen to get a handle that instead reads.

55.
```
void delete_list(node *head) {
   if(head == NULL)
      return;
   else {
      delete_list(head->next);
      free(head);
   }
   return;
}
```

56.
```
node *reverseList(node *head) {
   node *next, current, result = NULL;
   current = head;
   while(current != NULL) {
      next = current->next;
      current->next = result;
      result = current;
      current = next;
   }
   return result;
}
```

57. The error is in the segment that checks for insertion in the middle. The lines `predptr->next = newptr;` and `newptr->next = predptr->next;` need to be switched. Otherwise we are setting `newptr->next` to `newptr`!

58.
```
void delete(node *ele) {
   if(ele->prev == NULL)
      head = ele->next;
   else
      ele->prev->next = ele->next;
   if(ele->next == NULL)
      last = ele->prev;
   else
      ele->next->prev = ele->prev;
   free(ele);
}
```

59.
```
int treeSize(node *root) {
   if(root == NULL)
      return 0;
   else
      return treeSize(root->left) + 1 + treeSize(node->right);
}
```

60. If we insert onto the end of a chain, as opposed to the beginning of one, it would take $O(n)$ steps to insert.

61. Optimization of hash tables, such as by altering its size or by using different hash functions, can yield dramatically different results.

62. The probability of a collision is: $p = \frac{m-1}{m} * \frac{m-2}{m} * \ldots * \frac{m-n+1}{m}$, so the probability of no collision is $1 - p$

63.
```
int size(node *hashtable[]) {
   int i, size = 0;
   node *start;
   for(int i = 0; i < LENGTH; i++) {
      start = hashtable[i];
      while(start != NULL) {
         size++;
         start = start->next;
      }
   }
   return size;
}
```

64. The function should instead read as follows:

```
void printTree(node *root) {
   if(node == NULL)
      return;
   printTree(node->left);
   printf("%d ", node->data);
   printTree(node->right);
}
```

65. Everywhere I'm using the dot operator, I should be using the arrow operator!

66. There is a swap counter that stops the algorithm if equal to 0.

67. It doesn't check to see if swaps have been made.

68. It inserts onto the end of the list.

69. It inserts onto the front of the list.

70. It takes up a lot of memory to make a table that large...and most of it will be empty anyway!

71. Because it doesn't take any variables, instead it takes a "type", as an argument, and so it is properly classified as an operator.

72. It has a memory leak! `second` and `third` never get freed.

73.
```
hashtable[0]:
hashtable[1]:
hashtable[2]: peach
hashtable[3]:
hashtable[4]:
hashtable[5]:
hashtable[6]: banana
hashtable[7]: kiwi->apple->Cherry
hashtable[8]: lemon
hashtable[9]: clementine
```

74. There are potential problems with using scanf, strcpy, and the fourth and sixth printfs. One better way to write this would be:

```
#include <stdio.h>

int main(int argc, char **argv) {
   char buf[256], buf2[256];
   printf("Please enter a string\n");
   scanf("%255s", buf);
   strncpy(buf2, argv[1], 255);
   printf("The first command line argument you supplied was %s\n", buf2);
   printf(" the string you entered was %s", buf);
   return 0;
}
```

75. `<img src="blueflax.jpg" alt="Blue Flax" width=300 height=175 align="left" />`

76. (c)

77. `chmod` changes the "permissions" on a file, which control who can read, write, and execute a given file.

78. 651

79. `-rw-r-x--x`

80. `SELECT password FROM users WHERE username='malan'`

81. `INSERT INTO users (username, password, fullname) VALUES ('mtucker', 'l33t', 'Mike Tucker')`

82. `UPDATE users SET password='n3rd' WHERE username='malan'`

83. `SELECT * FROM users ORDER BY username DESC`

84. `SELECT COUNT(*) FROM users`

85. `DELETE FROM users WHERE username='cs50stud'`

86. ```
    <? $result = mysql_query("SELECT * FROM users"); ?>
    <tr><td>username</td><td>password</td><td>fullname</td></tr>
    <? while ($row = mysql_fetch_array($result)) { ?>
    <tr>
    <td><? print($row["username"]) ?></td>
    <td><? print($row["password"]) ?></td>
    <td><? print($row["fullname"]) ?></td>
    </tr>
    <? } ?>
    ```

87. Two functions that, together, work a single recursive unit.

88. Best-case runtime.

89. A language that does not need to be prepared into an object file before execution.

90. Languages that do not have explicit type declarations.

91. A computer science principle whereby we do not need to understand the inner workings of some code to be able to integrate with it.

92. A special type of function that instantiates an object with certain properties.

93. Like a queue, the first object inserted is the first object to be removed from the list.

94. A special case of a binary tree where the left subtree contains only nodes with keys less than the node's key, and where the right subtree contains only nodes with keys greater than the node's key.

95. A type of function that remembers certain aspects of the circumstances in which it was created. It is special in that it has free variables that are bound in the lexical environment.

96. Data that remains after a function or program has stopped running.
    ```

97.
```
<html>
   <script type=text/javascript>
   function turnGreen()
   {
      document.getElementById(colorflip).style.color = green;
   }
   </script>
   <body>
      <div id=colorflip>Turn me green!</div>
      <input type=button value="Do it!" onclick=turnGreen(); />
   </body>
</html>
```

98.
```
<head>
```

99.
```
$username = $_POST["username"];
```

100. The type of the password field should be "password", so as to obscure the input with asterisks.

101. Passwords are passed by `$_GET`, which is inherently weak. Also, the strings are not escaped to prevent a SQL injection attack.

102.
```
head
{
   background: purple;
   color: yellow;
   font-family: times;
   font-size: 30pt;
}
body
{
   background: green;
   color: red;
   border: orange 16px dotted;
   font-family: verdana;
   font-size: 20pt;
}
```

103. It is a metalanguage because it is used to generate code in another language, specifically XHTML.

104. Each is an associative array storing user-inputted variables.

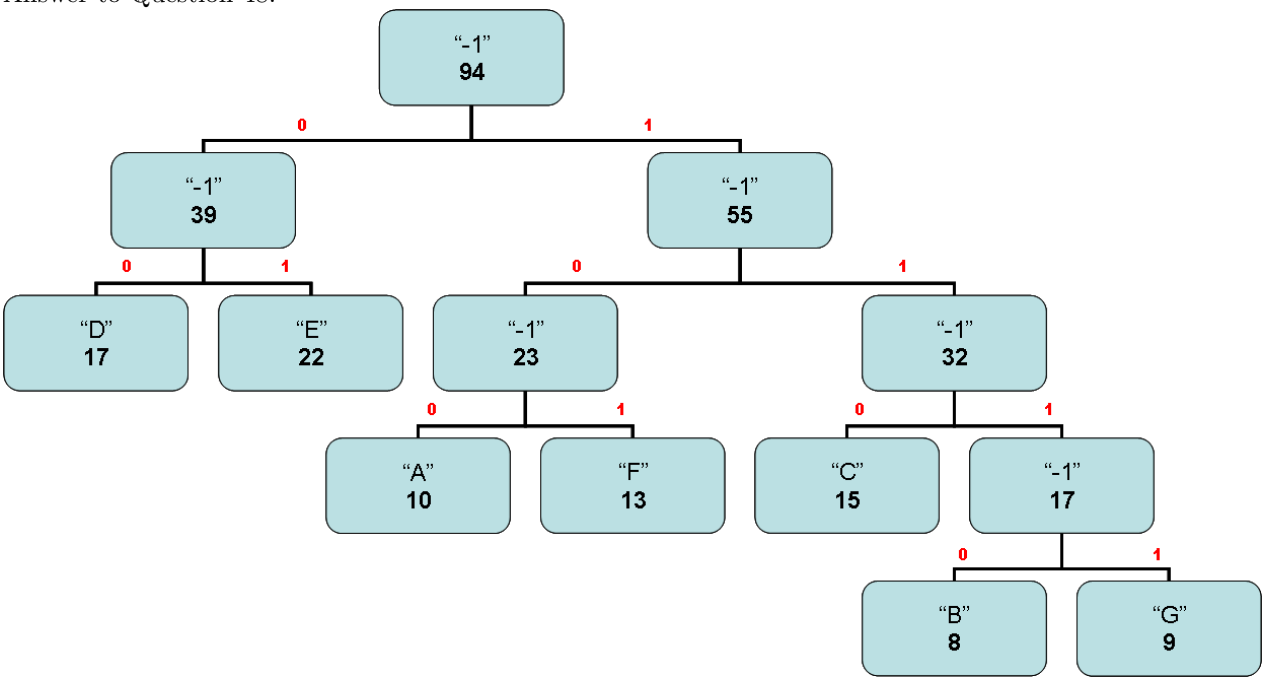
105.
```
function dollar_bills($amt) {
    $num = 0;
    while($amt > 0) {
       if($amt > 100) {
          $amt -= 100;
          $num++;
          continue;
       } else if($amt > 50) {

       ...and so on...

       } else if($amt == 1) {
          $amt--;
          $num++;
       }
    }
    return $num;
}
```

106. Answer is on page 12 of this answer key.

Answer to Question 48:



The encoding of each letter is thus:

A	100
B	1110
C	110
D	00
E	01
F	101
G	1111

Answer to Question 106:

(Note: Some elements have been omitted due to space constraints and for visual aesthetics)