CS 105: Sample Midterm Exam #1

Midterm Exam from Fall 2014

For the next five questions, consider the sales of iPhones by Apple. The data for each quarter of sales is reported to you in a table to the right (➜), and also represented as an array:

```
var sales = [ 0.27,  1.12,  2.32,  1.70,  0.72,  6.89,
              4.36,  3.79,  5.21,  7.37,  8.74,  8.75,
              8.40, 14.10, 16.24, 18.65, 20.34, 17.07,
             37.04, 35.06, 26.03, 26.91, 47.79, 37.43,
             31.24, 33.80, 51.03, 43.72 ];
```

Quarter & Year	iPhone Sales (m)
Q3 '07	0.27
Q4 '07	1.12
Q1 '08	2.32
Q2 '08	1.70
Q3 '08	0.72
Q4 '08	6.89
Q1 '09	4.36
Q2 '09	3.79
Q3 '09	5.21
Q4 '09	7.37
Q1 '10	8.74
Q2 '10	8.75
Q3 '10	8.40
Q4 '10	14.10
Q1 '11	16.24
Q2 '11	18.65
Q3 '11	20.34
Q4 '11	17.07
Q1 '12	37.04
Q2 '12	35.06
Q3 '12	26.03
Q4 '12	26.91
Q1 '13	47.79
Q2 '13	37.43
Q3 '13	31.24
Q4 '13	33.80
Q1 '14	51.03
Q2 '14	43.72

1. Which of the following lines of JavaScript correctly accesses the total number of iPhone sales during the second quarter of 2008 ("Q2 '08")?
    A. `sales[0]`
    B. `sales[1]`
    C. `sales[2]`
    D. `sales[3]`
    E. `sales[4]`

2. Which line of JavaScript correctly accesses the total number of data entries (quarters of years) available as part of our data?
    A. `sales.totalQuarters()`
    B. `total(sales)`
    C. `sizeof(sales)`
    D. `sales.size`
    E. `sales.length`

3. Consider the following segments of code that calculate the total sales of iPhones across all quarters and stores that total in a variable called `sum`:

(i)	(ii)	(iii)
| ```
var sum = 0;

for (var i = 0;
     i < sales.length;
     i++)
{
   sum += sales.i;
}
``` | ```
var sum = 0;

for (var i = 0;
     i < sales.length;
     i++)
{
   sum += sales[i];
}
``` | ```
var sum = 0;
var i = 0;

while (i < sales.length)
{
   sum += sales[i];
   i++;
}
``` |

Which code segments(s) correctly calculates the total number of iPhones sold?
    A. Only one segment correctly calculates the total (either (i), (ii), or (iii))
    B. Only (i) and (ii)
    C. Only (i) and (iii)
    D. Only (ii) and (iii)
    E. (i), (ii), and (iii)

In addition to the Apple iPhone data from the previous page, consider smartphone market share data from IDC. As with the iPhone data, the IDC market share data is also represented as an array in JavaScript:

```
var share_apple =
  [ 0.105, 0.130, 0.171, 0.163,
    0.154, 0.141, 0.166, 0.158,
    0.169, 0.182, 0.150, 0.238,
    0.225, 0.188, 0.143, 0.209,
    0.182, 0.142, 0.121, 0.178 ];
```

If you take a look at the two data sets to the right (➔), the iPhone sales data begins in the third quarter of 2007 (Q3 '07) but the sales data begins in the first quarter of 2009 (Q1 '09). In order to make accurate calculations, we must ensure that we use numbers from the same quarter. Specifically, this implies that we cannot simply use data from both `sales[0]` and `share_apple[0]` since the data refers to different dates.

Quarter & Year	Android	Apple
Q1 '09	1.6%	10.5%
Q2 '09	2.0%	13.0%
Q3 '09	3.5%	17.1%
Q4 '09	6.1%	16.3%
Q1 '10	9.6%	15.4%
Q2 '10	17.2%	14.1%
Q3 '10	25.3%	16.6%
Q4 '10	30.5%	15.8%
Q1 '11	36.4%	16.9%
Q2 '11	43.4%	18.2%
Q3 '11	52.5%	15.0%
Q4 '11	50.9%	23.8%
Q1 '12	56.9%	22.5%
Q2 '12	64.2%	18.8%
Q3 '12	72.6%	14.3%
Q4 '12	69.7%	20.9%
Q1 '13	74.4%	18.2%
Q2 '13	79.0%	14.2%
Q3 '13	81.9%	12.1%
Q4 '13	77.8%	17.8%

Quarter & Year	iPhone Sales (m)
Q3 '07	0.27
Q4 '07	1.12
Q1 '08	2.32
Q2 '08	1.70
Q3 '08	0.72
Q4 '08	6.89
Q1 '09	4.36
Q2 '09	3.79
Q3 '09	5.21
Q4 '09	7.37
Q1 '10	8.74
Q2 '10	8.75
Q3 '10	8.40
Q4 '10	14.10
Q1 '11	16.24
Q2 '11	18.65
Q3 '11	20.34
Q4 '11	17.07
Q1 '12	37.04
Q2 '12	35.06
Q3 '12	26.03
Q4 '12	26.91
Q1 '13	47.79
Q2 '13	37.43
Q3 '13	31.24
Q4 '13	33.80
Q1 '14	51.03
Q2 '14	43.72

For the next two questions, consider the following code segment:

```
1  for (var i = 0; i < share_apple.length; i++)
2  {
3     var apple_sales      = sales[i + offset];
4     var apple_marketshare = share_apple[i];
5     //    LINE 5
6  }
```

4. Suppose we want to ensure that the values in Line 3 and Line 4 contains data from the same quarter. What must the value of `offset` be set to ensure this is always true?
   A. `3`
   B. `4`
   C. `5`
   D. `6`
   E. `7`

5. Mathematically, we can calculate the total number of smartphones by taking the reciprocal of the market share and multiplying it by the number of units sold. For example, if Apple had 20% market share and sold 20 million (20m) units for a given quarter:

$$\underset{\substack{\text{Reciprocal of}\\\text{Market Share}}}{(1 / 0.2)} \quad * \quad \underset{\substack{\text{Units}\\\text{Sold}}}{20m} \quad = \quad \underset{\substack{\text{Reciprocal of}\\\text{Market Share}\\\text{(Calculated)}}}{5} \quad * \quad \underset{\substack{\text{Units}\\\text{Sold}}}{20m} \quad = \quad \underset{\substack{\text{Total}\\\text{Smartphones}\\\text{Sold}}}{100m}$$

Which line could be placed as Line 5 and correctly calculate the total smartphones sold?
   A. `var total_smartphones = apple_sales * apple_marketshare;`
   B. `var total_smartphones = (1 / apple_sales) * apple_marketshare;`
   C. `var total_smartphones = apple_sales * (1 / apple_marketshare);`
   D. `var total_smartphones = (1 / apple_sales) * (1 / apple_marketshare);`
   E. `var total_smartphones = (1 / (apple_sales * apple_marketshare));`

For the next three questions, consider the following code:

```
1  var x = 11;
2  while (x < 20)
3  {
4      print("Hello");
5      x *= 2;
6      if (x >= 10)
7      {
8          x -= 2;
9      }
10 }
```

6. Assuming that the function `print()` has been defined that prints the value passed in as the parameter to it, how many times is `"Hello"` printed?
  - A. 0
  - B. 1
  - C. 2
  - D. 3
  - E. Infinity (or at least until you kill the program)

7. If the initial value of `x` (set on Line #1) is now 5 instead of 11, how many times is `"Hello"` printed?
  - A. 0
  - B. 1
  - C. 2
  - D. 3
  - E. Infinity (or at least until you kill the program)

8. If the initial value of `x` (set on Line #1) is now -3 instead of 11, how many times is `"Hello"` printed?
  - A. 0
  - B. 1
  - C. 2
  - D. 3
  - E. Infinity (or at least until you kill the program)

9. Suppose we have a program where we are searching through data in an array millions of times. If we want our program to run as fast as possible while getting the correct result, how should we search our data?
  - A. Set up our data in any order and use a linear search
  - B. Set up our data in any order and use a binary search
  - C. Set up our data in any order and use a selection search
  - D. Set up our data in sorted order and use a linear search
  - E. Set up our data in sorted order and use a binary search

For the next two questions, consider the following code:

```
1  function fun(g)
2  {
3     var ct = 0;
4     for (var i = 0; i < g.length; i++)
5     {
6        var gi = g[i];
7        if (gi == "A" || gi == "B" || gi == "C")
8        {
9           ct++;
10       }
11    }
12    return ct;
13 }
```

10. Based on its usage in the function, what type of variable must g be?
   A. A string
   B. A number
   C. An array of strings
   D. An array of numbers
   E. An array of arrays

11. Which of the following best describes the return value of the `fun()` function?
   A. The function returns the number of passing grades from the input array g
   B. The function returns the total number of letters in the input string g
   C. The function returns the length of the input g
   D. The function returns the sum of the values from the input array g
   E. The function always returns 0

12. What is the decimal (base 10) value of the following binary number: 1001
   A. 3
   B. 5
   C. 6
   D. 7
   E. 9

13. What is the binary (base 2) value of the following decimal number: 5
   A. 001
   B. 010
   C. 100
   D. 101
   E. 110

14. What is ASCII code?
   A. A special version of JavaScript that we are using in CS 105
   B. A universally recognized translation between letters and numbers
   C. An encryption technique that makes text hard to read
   D. A programming language used to make Android and iPhone apps
   E. The five primary colors of light used on a computer screen

In MP1, you created a program allowing the user to guess a randomly generated number by the computer. In many ways, checking if a guessed number matches some randomly chosen number is very similar to a lottery system.

For the next four questions, suppose you guessed five numbers within the range [1, 99] and stored them in the array `guesses`. Additionally, a variable `secretNumber` has been defined and contains a single secret number from the same range. Consider the following code:

```
1   // Loop through each element within the guesses array
2        Line 2
3   {
4      // Get a single guess out of the array
5           Line 5
6
7      // Check if our guess is our secret number.
8           Line 8
9      {
10          print("Winner!");
11     }
12  }
```

15. Which line of code should be placed into Line 2?
- A. `for (var i = 0; i < guesses.length; i++)`
- B. `while (var i = 0; i < guesses.length; i++)`
- C. `if (i < guesses.length)`
- D. `while (i < guesses.length)`

16. Which line of code should be placed into Line 5?
- A. `var guess = readline();`
- B. `var guess = readline(guess[i]);`
- C. `var guess = guess[i];`
- D. `var guess = guesses[i];`

17. Suppose we have a function `check()` that takes in two parameters, both numbers, and returns `true` if the integers are equal and `false` otherwise. Which line of code should be placed into Line 8 to complete the program?
- A. `var result = check( guess, secretNumber );`
- B. `while ( check( guess, secretNumber ) == true )`
- C. `while ( check( guess, secretNumber ) != true )`
- D. `if ( check( guess, secretNumber ) == true )`
- E. `if ( check( guess, secretNumber ) != true )`

FR1.
15 pts.
Write the `check()` function that was defined in the previous question. Remember that `check()` takes in two parameters and returns a value. Your answer must include the full function, not just what is contained inside of the function.

...answer this question on your free response answer sheet as question FR1.

Continuing from the previous page, suppose we now have an array of `secretNumbers` instead of a single `secretNumber`. Instead of simply printing out "Winner", the code calculates the correct number of correct guesses and places that in the variable `correctGuesses`.

For example, the value of `correctGuess` would be 3 after the program executes if the input to our program was the following arrays (10, 18, and 55 being the three correct guesses):

```
var secretNumbers = [  2, 10, 18, 36, 55 ];
var guesses       = [ 10, 17, 18, 55, 99 ];
```

18. In our example arrays given above, how many times would the `secretNumbers` array need to be checked **in the worst case** to determine if a single guess was in the array of secret numbers using a **linear search**?
    Hint: The worst case occurs when a guess is not in the secret numbers list.
    A. 1
    B. 2
    C. 3
    D. 4
    E. 5

19. In our example arrays given above, how many times would the `secretNumbers` array need to be checked **in the worst case** to determine if a single guess was in the array of secret numbers using a **binary search**?
    Hint: The worst case occurs when a guess is not in the secret numbers list.
    A. 1
    B. 2
    C. 3
    D. 4
    E. 5

20. Suppose we want to calculate a payout that is based on how many numbers they have guessed correctly. If zero or one numbers are correct, the payout is 1; two numbers correct, the payout is doubled to 2; three numbers, the payout is doubled again to 4; four numbers, payout is 8; all five, 16.

(i)	(ii)	(iii)
``var payout = 1;

for (var i = 0;
     i < correctGuesses;
     i++)
{
   payout *= 2;
}
``` | ```var payout = 1;

while (correctGuesses > 1)
{
   payout *= 2;
   correctGuesses--;
}
``` | ```var payout = 1;
payout *= correctGuesses;

if (correctGuesses == 3)
{ payout++; }
if (correctGuesses == 4)
{ payout *= 2; }
if (correctGuesses == 5)
{ payout += 11; }
``` |

Which code segments(s) correctly calculates the payout in the variable `payout`?
    A. Only one segment correctly calculates the total (either (i), (ii), or (iii))
    B. Only (i) and (ii)
    C. Only (i) and (iii)
    D. Only (ii) and (iii)
    E. (i), (ii), and (iii)

One recent trend in social networking is location-aware or location-based social networking. In these apps, a post can only be made and/or seen if the user is within a certain distance from a set point. For example, in order to post as part of the University of Illinois, you must be within 10 miles of the University of Illinois within a location-aware app.

In order to check the distance, we have a `findDistance()` function has already been defined for you. This function takes in two JavaScript objects that define a location and returns the approximate distance between the two locations in miles:

```
1   function findDistance( location1, location2 )
2   {
3      /* Find the distance in the x-direction */
4      var dx = location2.x - location1.x;
5
6      /* Find the distance in the y-direction */
7      var dy = location2.y - location1.y;
8
9      /* Use the Pythagorean Theorem to find the distance */
10        Line 10
11
12     /* Each latitude/longitude degree is about 65 miles */
13     return (dist * 65);
14  }
```

21. In mathematics, the Pythagorean Theorem, $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{x^2 + y^2}$, tells us the distance between two points in 2D-space. If `Math.sqrt()` is a JavaScript function to find the square root of an input parameter, what line of code should be placed in Line 10 to find the distance between the two locations passed into the function `findDistance()` abvoe?
    A. `var dist = Math.sqrt( location1 + location2 );`
    B. `var dist = Math.sqrt( location1.x + location2.y );`
    C. `var dist = Math.sqrt( (location1.x)^2 + (location2.y)^2 );`
    D. `var dist = Math.sqrt( dx + dy );`
    E. `var dist = Math.sqrt( (dx * dx) + (dy * dy) );`

22. Given the location of The University of Illinois is at 40.1105° N, 88.2284° W, which of the following lines of code correctly defines a JavaScript object that can be passed into `findDistance()` as one of its two input parameters?
    A. `var location = 40.1105, -88.2284;`
    B. `var location = [40.1105, -88.2284];`
    C. `var location = [x: 40.1105, y: -88.2284];`
    D. `var location = <x>40.1105</x><y>-88.2284</y>;`
    E. `var location = { x: 40.1105, y: -88.2284 };`

FR2.
15 pts.
Writhe a JavaScript function called `checkAccess()` that takes in two location objects as parameters, `university_location` and `user_location`, and returns `true` if and only if the user's location is within 10 miles of the university's location. Otherwise, the function must return `false`. In your function, you must use the `findDistance()` function defined at the top of this page to find the distance.
...answer this question on your free response answer sheet as question FR2.

For the next four problems, consider a payment such as a rent or a credit card payment. The variable `daysLate` stores the value of the number of days you are late on a payment.

23. If the penalty is $20 per day late, which of the following lines of code accurately calculates the late penalty?
  A. `var penalty = daysLate + 20;`
  B. `var penalty = daysLate ^ 20;`
  C. `var penalty = daysLate && 20;`
  D. `var penalty = daysLate * 20;`
  E. `var penalty = daysLate;`

24. For a different payment, the penalty is calculated with the following code:

```
1  var penalty;
2  if (daysLate < 3)
3  {
4     penalty = 0;
5  }
6  else
7  {
8     penalty = daysLate - 3;
9  }
```

What is an accurate English description of the code displayed above?
  A. If the payment is **more than** three days late, the penalty is the number of days the payment was late. Otherwise, there is no penalty.
  B. If the payment is **more than** three days late, the penalty is three dollars less than the number of days the payment was late. Otherwise, there is no penalty.
  C. If the payment is **less than** three days late, the penalty is the number of days the payment was late. Otherwise, there is no penalty.
  D. If the payment is **less than** three days late, the penalty is three dollars less than the number of days the payment was late. Otherwise, there is no penalty.

25. For yet another payment, this payment offers a grace period of `gracePeriod` days where no penalty will be given if the payment is made within the number of grace period days. (This means that, if the grace period is three days, no penalty is given if the payment is made one, two, or three days late.) What is the conditional that is true if the payment is made within the grace period?
  A. `if ( gracePeriod < daysLate )`
  B. `if ( gracePeriod <= daysLate )`
  C. `if ( gracePeriod > daysLate )`
  D. `if ( gracePeriod >= daysLate )`
  E. `if ( gracePeriod == daysLate )`

26. What type of data is stored in the variable `daysLate`?
  A. A number
  B. A string
  C. An array of numbers
  D. An array of strings
  E. An array of arrays

In Lab 4, you wrote a simple JavaScript function to determine if a dealer in blackjack should hit or stand. As input to this function, your function was given an array of strings that each represented a playing card:

```
var hand = ["D3", "H9", "C8"];
```

27. Which line of code would correctly extract the card from the array **hand** at index **i**?
- A. **var card = hand[i];**
- B. **var card = hand.charAt(i);**
- C. **var card = hand[i].charAt();**
- D. **var card = hand[i].charAt(i);**
- E. **var card = hand.charAt(i)[i];**

[This question had serious typos and everyone received credit for it.]

28. ~~The suit of a card is located at as the second character in the string that represents each card. For example, the rank of **"D3"** is "D". Given that the variable **card** contains the string representation of a single card, which line of code correctly finds the suit of **card**?~~
- A. ~~**var suit = card[0].charAt();**~~
- B. ~~**var suit = card.charAt(0);**~~
- C. ~~**var suit = card[1];**~~
- D. ~~**var suit = card[1].charAt();**~~
- E. ~~**var suit = card.charAt(1);**~~

29. Suppose we want to display the suit of the card on the website for the user to see within a **<div>** tag in HTML that has an **id** attribute with the value **"cardSuit"**. Which line of code would change the text on the website to the card rank stored in the variable **suit**?
- A. **document.getElementById(suit).innerHTML = suit;**
- B. **document.getElementById(suit).innerHTML = "cardSuit";**
- C. **document.getElementById("cardSuit").innerHTML = suit;**
- D. **document.getElementById("cardSuit").innerHTML = " cardSuit";**

30. In order to run JavaScript code on an HTML page, what attribute must be added to an HTML tag for JavaScript to run when the HTML element is clicked?
- A. **js**
- B. **onClick**
- C. **javaScript**
- D. **document.getElementById(s).innerHTML**
- E. **document.getElementById("id").innerHTML**

FR3.
15 pts. Suppose we now created an array that contained only the suit of the card. As an example, our original array hand array would now be: **["D", "H", "C"]**.

Writhe a JavaScript function called **red()** that takes in one input parameter, an array of **card suits** *(not the full card)*, and returns the number of red cards in the hand. A card is considered red if the suit is either a diamond (**"D"**) or a heart (**"H"**). As an example, the array **["D", "H", "C"]** contains two red cards.
...answer this question on your free response answer sheet as question FR3.

This page was intentionally left blank.