

**CS 105 Final Exam**  
Final Exam form Spring 2015

Consider a small business where you are selling strawberries. The price of for the current season is \$3.00 per pound for the first five pounds and \$2.00 per pound for each pound above the first five pounds.

1. What is the total price of 10 bounds of strawberries?
  - A. \$10.00
  - B. \$15.00
  - C. \$20.00
  - D. \$25.00
  - E. \$30.00

For the next three questions, consider the following `findPrice` function that takes in the number of pounds of strawberries ordered as input and returns the price of the order.

1	<code>var findPrice = function(pounds) {</code>
2	<code>  var price = 3 * pounds;</code>
3	
4	<code>  if ( <u>Line 4</u> ) {</code>
5	<code> <u>Line 5</u></code>
6	<code>  }</code>
7	
8	<code> <u>Line 8</u>;</code>
9	<code>}</code>

2. If Line 5 should only be executed by the computer if an order is at least five pounds, what conditional should be placed into the blank on Line 4?
  - A. `5 > price`
  - B. `price > 5`
  - C. `5 > pounds`
  - D. `pounds > 5`
3. Which line out of the following lines of code must be placed into the blank on Line 5 to ensure that price is calculated correctly?
  - A. `price += pounds * 3;`
  - B. `price += pounds * 2;`
  - C. `price -= pounds * 1;`
  - D. `price += (pounds - 5) * 2;`
  - E. `price -= (pounds - 5) * 1;`

4. Suppose a program uses the `findPrice` function by the following line of JavaScript:

```
var totalPrice = findPrice(10);
```

Which line of code must be placed into the blank on Line 8 so that the `findPrice` function will correctly populate `totalPrice` with the correct price?

- A. `return price;`
- B. `return pounds;`
- C. `console.log(price);`
- D. `console.log(pounds);`
- E. `console.log(totalPrice);`

Suppose you opened your own bakery and sold three types of treats: cookies, muffins, and cupcakes. As a sales tactic, you charge a different price per item based on the quantity of the item a customer buys. For example, if a customer orders 1 or 2 cookies, the cookies are \$1.00 each; if the customer orders 3 or 4 cookies, the cookies are \$0.80 each; 5-9 cookies are \$0.75 each; and 10 or more cookies are \$0.60.

Your Excel Workbook contains two sheets. The first sheet, Menu, contains the prices of your items based on the minimum quantity ordered (as explained above):

	A	B	C	D	E
1		<b>Minimum Quantity / Price per Item</b>			
2	<b>Item Type</b>	<b>1</b>	<b>3</b>	<b>5</b>	<b>10</b>
3	Cookie	\$ 1.00	\$ 0.80	\$ 0.75	\$ 0.60
4	Muffin	\$ 2.00	\$ 1.90	\$ 1.75	\$ 1.50
5	Cupcake	\$ 3.00	\$ 2.75	\$ 2.50	\$ 2.25
<b>Sheet Name:</b>		<b>Menu</b>	Order		

The second sheet contains the order processing logic, where data is entered in order to process the order:

	A	B	C	D	E	F
1		<b>Quantity</b>			<b>Column</b>	<b>Total</b>
2	Cookies Ordered:	3		Cookie Sub-Total:		
3	Muffins Ordered:	1		Muffin Sub-Total:		
4	Cupcakes Ordered:	12		Cupcake Sub-Total:		
5					<b>Grand Total:</b>	
<b>Sheet Name:</b>		Menu	<b>Order</b>			

5. Which formula can be used in **Order!E2** to find the correct column number within **Menu!B2:E2** to be used to calculate the price based on the quantity ordered? (For example, an order of 4 cookies would use the column number 2 within **B2:E2** since column the second column in **B2:E2** represents a quantity of 3-4 cookies ordered.)
- =MATCH( Order!B2, Menu!B\$2:E\$2, 0 )**
  - =MATCH( Order!B2, Menu!B\$2:E\$2, 1 )**
  - =INDEX( Order!A\$3:A\$5, MATCH( Order!B2, Menu!B\$2:E\$2, 1), 0)**
  - =INDEX( Order!A\$3:A\$5, MATCH( Order!B2, Menu!B\$2:E\$2, 0), 1)**
  - =INDEX( Order!A\$3:A\$5, MATCH( Order!B2, Menu!B\$2:E\$2, 1), 1)**
6. Suppose you copied your formula from the previous question (cell **E2**) and pasted it into **E3** and **E4**. Will **E3** and **E4** have formulas that calculate the correct values?
- Yes
  - No
- FR1.** Write a formula that can be used in **F2** to calculate the total price for **all of the cookies** purchased (not just the price for one cookie, but **all** the cookies in the order). (20pts)

In writing this formula, you should assume that cell **E2** has been filled in correctly. It is **not necessary** to make your formula able to be copied and pasted into other cells. (It just needs to work in **F2**.)

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

Suppose you have been hired as a consultant on a major renovation of a building. After some research, you identified several ways to reduce the energy usage in the building:

	A	B	C	D	E
1	<b><u>Project / Renovation</u></b>	<b><u>Initial Cost</u></b>	<b><u>Yearly Savings</u></b>	<b><u>Recovery</u></b>	<b><u>Efficiency</u></b>
2	LED Lighting	\$ 300,000	\$ 12,000		
3	Updated HVAC System	\$ 800,000	\$ 40,000		
4	High-R Windows	\$ 1,200,000	\$ 60,000		
5	Motion Detection Lighting	\$ 1,600,000	\$ 40,000		
6	Green Rooftop	\$ 2,100,000	\$ 70,000		
7	Low-Energy Elevators	\$ 3,700,000	\$ 200,000		

7. Which column(s) can be searched correctly when using **TRUE** as the value for the fourth parameter (**range\_lookup**) in the **VLOOKUP** function?
  - A. Only Column A
  - B. Only Column B
  - C. Only Column C
  - D. Only columns B and C
  - E. Columns A, B, and C
  
8. Which column(s) can be searched correctly when using **FALSE** as the value for the fourth parameter (**range\_lookup**) in the **VLOOKUP** function?
  - A. Only Column A
  - B. Only Column B
  - C. Only Column C
  - D. Only columns B and C
  - E. Columns A, B, and C
  
9. Column D requires the calculation of the “Capital Recovery”, the number of years it will take for the yearly savings to add up to the initial cost of the project. For example, the “Updated HVAC System” takes 20 years to recover the initial capital ( $\$40,000 * 20 = \$800,000$ ). Which formula can be used in **D2** to calculate the Capital Recovery?
  - A. **=B2 \* C2**
  - B. **=B2 - C2**
  - C. **=C2 - B2**
  - D. **=B2 / C2**
  - E. **=C2 / B2**
  
10. Column E requires the calculation of an “Efficiency” of a project, which is defined to be 100 times the yearly savings divided by the initial cost of the project. Which formula can be used in **E2**, and then copied and pasted into **E3:E7**, to calculate Efficiency?
  - A. **=100 \* (B2 / C2)**
  - B. **=100 \* (\$B\$2 / \$C\$2)**
  - C. **=100 \* (C2 / B2)**
  - D. **=100 \* (\$C\$2 / \$B\$2)**

This page continues to use the same spreadsheet as the previous page. At this point, you should assume that all cells are now completed:

	A	B	C	D	E
1	<u>Project / Renovation</u>	<u>Initial Cost</u>	<u>Yearly Savings</u>	<u>Recovery</u>	<u>Efficiency</u>
2	LED Lighting	\$ 300,000	\$ 12,000	25	4
...	...	...	...	...	...

11. Which formula can be used to find the name of the project with the highest “Efficiency” rating?

- A. =MAX(E:E)
- B. =MATCH(MAX(E:E), E:E, 1)
- C. =VLOOKUP(A:E, MAX(E:E), 5, FALSE)
- D. =VLOOKUP(MAX(E:E), A:E, 5, FALSE)
- E. =INDEX(A:A, MATCH(MAX(E:E), E:E, 0), 1)

12. Which formula finds the total number of projects where the initial cost is less than \$2,000,000?

- A. =COUNT(B:B)
- B. =SUM(B:B)
- C. =COUNTIFS(B:B, "<2000000")
- D. =SUMIFS(B:B, B:B, "<2000000")
- E. =IF(B:B > 2000000, 1, 0)

13. Which formula finds the total initial cost of all projects that have an “Efficiency” rating of at least 5?

- A. =COUNTIFS(E:E, ">=5")
- B. =SUMIFS(E:E, B:B, ">=5")
- C. =SUMIFS(B:B, E:E, ">=5")
- D. =IF(E:E <= 5, B:B, 0)
- E. =IF(B:B <= 5, E:E, 0)

14. Suppose we created a new column, Column F, that describes the project as either “Great” (Efficiency of 10 or more), “Good” (Efficiency between 10 and 4), or “Poor” (Efficiency of 4 or less). Which formula could be used in F2 to display the correct description of the project?

- A. =IF(E2 > 10, "Great", E2 < 4, "Poor", "Good")
- B. =IF(E2 > 10, "Great", IF(10 < E2 < 4, "Good", "Poor"))
- C. =IF(E2 > 4, "Good", IF(E2 > 10, "Great", "Poor"))
- D. =IF(E2 > 4, "Good", IF(E2 < 4, "Poor", "Great"))
- E. =IF(E2 < 4, "Poor", IF(E2 > 10, "Great", "Good"))

**FR2.** Write a formula that finds the total initial cost of all projects that are rated as “Great”.  
(20pts)

In writing this formula, you should assume that Column F has the correct rating for each of the projects (described in the previous question).

...answer this question on your free response answer sheet as question FR2.

For the next eight questions, consider an Excel sheet of the inventory of a fabric store:

	A	B	C	D	E	F	G
1	Fabric	Style	Color	Inventory (linear yards)	Price /yd	Width (in.)	\$ /in <sup>2</sup>
2	Silk	Charmeuse	Ivory	40	\$ 12.80	44	
3	Silk	Organza	Midnight Navy	38	\$ 17.60	82	
4	Cotton	Shirting	Blue/White	118	\$ 12.00	56	
5	Cotton	Sateen	Covert Green	81	\$ 14.40	54	
6	Rayon	Brocade	Earth Tones	37	\$ 12.80	60	
...	...	...	...		...	...	

15. How many linear yards of silk fabrics does the store have in inventory (ignoring the width)?

- A. =COUNT(D:D)
- B. =COUNTIFS(A:A, "Silk")
- C. =SUM(D:D)
- D. =SUMIFS(D:D, A:A, "Silk")

Fabric is bought and sold in a unit called a **linear yard**. A linear yard is a yard of fabric in length, regardless of the width of the fabric. Therefore, buying a linear yard of a fabric that is 20" in width (*Total area: 720 in<sup>2</sup>*) gets you only half as much fabric as buying a linear yard of fabric that is 40" in width (*Total area: 36" (1 yd.) \* 40" = 1440 in<sup>2</sup>*).

As a reminder, you can find the area by multiplying a length by a width when both the length and the width are in the same unit. If the length and width are both in inches, your answer is the area in terms of square inches (in<sup>2</sup>). *One yard is equal to exactly 36 inches.*

16. Which formula can be placed into G2 that correctly calculates the price per square inch (in<sup>2</sup>) for the fabric on the current row?

- A. =E2 / (36 \* F2)
- B. =(36 \* F2) / E2
- C. =E2 / (1 \* (F2/36))
- D. =(1 \* (F2/36)) / E2
- E. =E2 \* (F2/36)

17. Is it necessary to lock any of the values in G2 before copying/pasting G2 into G:G?

- A. Yes, you must lock one or more values in G2's formula
- B. No, it not necessary to lock any of the values in G2's formula

18. Which formula finds the color of the fabric that is cheapest in terms of dollars per square inch?

- A. =MIN(C:C, G:G)
- B. =VLOOKUP( MIN(C:C), A:G, 7, FALSE )
- C. =VLOOKUP( MIN(G:G), A:G, 3, FALSE )
- D. =INDEX( C:C, MATCH(MIN(G:G), G:G, 0), 1 )
- E. =INDEX( G:G, MATCH(MIN(C:C), C:C, 0), 1 )

Suppose we used a tool, such as the CSV to JSON tool shown in class, to convert our Excel sheet into a JavaScript object (JSON):

```
1 var data = [  
2   { fabric: "Silk", style: "Charmeuse", color: "Ivory",  
3     inventory: 40, price: 12.80, width: 44 },  
4  
5   { fabric: "Silk", style: "Organza", color: "Midnight Navy",  
6     inventory: 38, price: 17.60, width: 82 },  
7  
... /* ... */  
694 ];
```

19. What is the data type of the variable `data`?
- A. A number
  - B. An array of numbers
  - C. An object of numbers
  - D. An array of objects
  - E. An object of arrays
20. Which of the following contains the value "Midnight Navy"?
- A. `color[data].0`
  - B. `data.color[0]`
  - C. `data.color[1]`
  - D. `data[0].color`
  - E. `data[1].color`
21. Which of the following has the value 5?
- A. `data[0].width`
  - B. `data[1].inventory`
  - C. `data[1].color`
  - D. `data[0].color.length`
  - E. `data[1].width.length`

Consider the following code snippet:

```
1 var x = data[0];  
2  
3 for (var i = 0; i < data.length; i++) {  
4   var d = data[i];  
5   if (d.inventory < x.inventory)  
6     x = d;  
7 }
```

22. What best describes the value of `x` after the code has run?
- A. `x` contains the fabric in the inventory that is the cheapest
  - B. `x` contains the fabric in the inventory that is the most expensive
  - C. `x` contains the fabric in the inventory that is the most profitable
  - D. `x` contains the fabric that there is the most linear yards of inventory
  - E. `x` contains the fabric that there is the least linear yards of inventory

Finally, suppose we want to begin to create a visualization of this inventory. To do so, we use the following code, where `svg` has been initialized as a standard d3.js visualization.

```
1  svg.selectAll("rect")
2    .data(data2)
3    .enter()
4    .append("rect")
5    .attr("width", function (d) { return d.width; })
6    .attr("height", function (d) { return d.inventory; })
7    .attr("x", 0)
8    .attr("y", 0)
9    .attr("stroke", "Black")
10   .attr("fill", function (d) { return d.color; });
```

To simplify the visualization, the `data2` variable that is being used in Line 2 contains only the first two objects of our data set (not the entire data sheet seen earlier):

```
1  var data2 = [
2    { fabric: "Silk", style: "Charmeuse", color: "Ivory",
3      inventory: 40, price: 12.80, width: 44 },
4
5    { fabric: "Silk", style: "Organza", color: "Midnight Navy",
6      inventory: 38, price: 17.60, width: 82 }
7  ];
```

23. What shape is being drawn by the d3.js code?

- A. Line
- B. Circle
- C. Rectangle
- D. Map
- E. SVG

24. How many shapes are being drawn?

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

**FR3.** Draw the visualization created by the d3.js code.  
(20pts)

In drawing your visualization, you should consider “Ivory” to be light/clear/un-shaded and both “Midnight Navy” and “Black” to be dark/shaded/filled in.

We are not concerned about the shapes being perfect sizes, though the proportions should be approximately correct. It is okay to add an axis and/or grid in order to make it more clear to us what you are drawing, though this is not necessary.

*...answer this question on your free response answer sheet as question FR3.*



For the next five questions, consider the following Excel spreadsheet of highest lifetime grossing films in the United States domestic market:

	A	B	C	D	E	F
1	<u>Name of Movie</u>	<u>Gross (\$m)</u>	<u>Year</u>	<u>Studio</u>	<u>Years Ago</u>	<u>\$ /year</u>
2	Avatar	760.5	2009	Fox		
3	Titanic	658.7	1997	Paramount		
4	Marvel's The Avengers	623.4	2012	BV		
5	The Dark Knight	534.9	2008	WB		
6	Star Wars: Episode 1	474.5	1999	Fox		

25. What formula returns the **gross income**, in millions (\$m), that the highest grossing film has grossed?

- A. =MAX(B:B)
- B. =MAX(A:F)
- C. =AVERAGE(B:B)
- D. =INDEX(A:A, MATCH(MAX(B:B), B:B, 0))
- E. =VLOOKUP(A:A, A:F, 2, FALSE)

26. What formula returns the **average amount of gross income**, in millions (\$m), that was made among the top file all-time highest grossing movies?

- A. =MAX(B:B)
- B. =MAX(A:F)
- C. =AVERAGE(B:B)
- D. =INDEX(A:A, MATCH(MAX(B:B), B:B, 0))
- E. =VLOOKUP(A:A, A:F, 2, FALSE)

27. What formula, which can be placed in E2 and copied/pasted into E3:E6, calculates the total number of years that have passed since the year the movie was first released. (For example, Avatar was released in 2009, which was 5 years ago.)

- A. =2014 - C2
- B. =C2 - 2014
- C. =2014 - MIN(C:C)
- D. =MIN(C:C) - 2014

28. Assuming E:E are solved and correct, which formula calculates the average amount of money the movie has made per year since it has been released and can be placed in F2?

- A. =B2 / E2
- B. =B:B / E:E
- C. =AVERAGE(B:B) / AVERAGE(E:E)
- D. =AVERAGE(B2, E2)

29. In order to find the **name** of the movie with the earliest release, which of the following is true among the functions you have learned in CS 105?

- A. You can only use VLOOKUP to do this
- B. You can use either VLOOKUP or INDEX/MATCH to do this
- C. You can only use INDEX/MATCH to do this
- D. You can only use a pivot table to do this
- E. This is not possible to do based on what was taught in CS 105

Consider the following Excel sheet for the next four questions:

	A	B	C	D
1	<b>Date</b>	<b>Merchant</b>	<b>Type</b>	<b>Amount</b>
2	Apr. 16, 2015	App Multiverse	Department Store	\$ 1.99
3	Apr. 16, 2015	Caffeine Comrade	Restaurant	\$ 4.57
4	Apr. 17, 2015	Pizza Portal	Restaurant	\$ 17.57
5	Apr. 18, 2015	Akihabara Aces	Department Store	\$ 56.20
6	Apr. 18, 2015	Grub2Go	Restaurant	\$ 3.56
7	Apr. 20, 2015	Produce Peddler	Grocery	\$ 30.15
8	Apr. 21, 2015	Pizza Portal	Restaurant	\$ 18.08
9				
10	<b>Average Expenditure:</b>			
11	<b>Expenditure on Restaurants</b>			
12	<b>Number of Department Store Expenses:</b>			
13	<b>Total Expenditures:</b>			

30. If the Average Expenditure per transaction is to be calculated in D10, which one of the following formulas should be used?
- =AVERAGE (D2:D8)
  - =SUM (D2:D8) / (A8 - A2)
  - =(E4 : E10) / COUNT (D4:D10)
  - =AVG (E4 : E10)
  - =SUM (D2:D8)
31. If the Expenditure on Restaurants is to be calculated in D11, which one of the following formulas should be used?
- =VLOOKUP ("Restaurant", SUM (D2:D8), 2, TRUE)
  - =SUM (D2 : D8) IF (D = "Restaurant")
  - =SUMIFS (D2:D8, C2:C8, "Restaurant")
  - =SUMIFS (D2:D8, C2:C8, ="Restaurant")
  - =SUM (D2:D8)
32. If the Number of Department Store Expenses is to be calculated in D12, which one of the following formulas should be used?
- =COUNT (D2:D8, "Department Store")
  - =COUNTIFS (C2:C8, "Department Store")
  - =SUMIFS (C2:C8, "Department Store")
  - =COUNT (C:C, "Department Store")
  - =SUM (D2:D8)
33. If the Total Expenditure is to be calculated in D13, which one of the following formulas should be used?
- =AVERAGE (D2:D8)
  - =SUM (D2:D8) / (A8 - A2)
  - =(E4 : E10) / COUNT (D4:D10)
  - =AVG (E4 : E10)
  - =SUM (D2:D8)

Suppose we want to take a summer road trip and want to visit five places:

```
1 var locations = ["Boston", "Chicago", "New York City",  
2               "San Francisco", "Seattle"];
```

34. What type of data is the variable `locations`?

- A. Array
- B. Boolean
- C. Number
- D. Object
- E. String

Google provides a way that allows us to leverage their mapping technology to return the distance between two locations. To help us with figuring out our summer road trip, we have provided a function that takes two cities as parameters to a JavaScript function and returns the distance between these functions:

```
1 var findDistance = function(location1, location2) {  
2   // Asks Google for the distance between two cities  
...  
...  
18  // Returns the distance (a Number), for example:  
19  //   findDistance("New York City", "Boston") == 215  
20  return distance;  
21 }
```

35. What type of data is returned by the `findDistance` function?

- A. Array
- B. Boolean
- C. Number
- D. Object
- E. String

Finally, we need to call `findDistance` to get the distance between each pair of locations:

```
1 var locations = ["Boston", "Chicago", "New York City",  
2               "San Francisco", "Seattle"];  
3  
4 for (var i = 0; i < locations.length; i++) {  
5   for (var j = 0; j < locations.length; j++) {  
6     var dist = Line 6; /* ... */  
7   }  
8 }
```

36. What code should be placed in Line 6 to store the distance between two locations in the variable `dist`?

- A. `findDistance( locations[i], locations[j] )`
- B. `findDistance( locations.i, locations.j )`
- C. `findDistance( locations[i, j] )`
- D. `findDistance( locations@i, locations@j )`

After running the code on the previous page, we constructed an Excel spreadsheet with the locations and distances:

	A	B	C	D	E	F
1		<b>Boston</b>	<b>Chicago</b>	<b>NYC</b>	<b>SF</b>	<b>Seattle</b>
2	<b>Boston</b>	--	982	215	3100	3045
3	<b>Chicago</b>	982	--	790	2130	2064
4	<b>NYC</b>	215	790	--	2907	2858
5	<b>SF</b>	3100	2130	2907	--	808
6	<b>Seattle</b>	3045	2064	2858	808	--
Sheet Name:		Distances	Routes			

37. Looking at the data above, New York City ↔ Boston has the shortest distance between any two cities. Which of the following Excel formulas would return one of the two cities that are part of this shortest distance?

- A. =INDEX( A1:F6, MATCH( MIN(A1:F6), A1:F6, 0), 1 )
- B. =INDEX( A1:F6, 1, MATCH( MIN(A1:F6), A1:F6, 0) )
- C. =VLOOKUP( MIN(A1:F6), A1:F6, MATCH(MIN(A1:F6)), FALSE )
- D. None of the above

In order to find the shortest road trip, we must consider every possible route. To do this, we have created a **Routes** sheet with every possible route:

	A	B	C	D	E	F	G	H	I	J
1	<b>#1</b>	<b>#2</b>	<b>#3</b>	<b>#4</b>	<b>#5</b>	<b>1→2</b>	<b>2→3</b>	<b>3→4</b>	<b>4→5</b>	<b>Total</b>
2	Boston	Chicago	NYC	SF	Seattle	982	790	2907	808	5487
3	Boston	Chicago	NYC	Seattle	SF	982	790	2858	808	5438
4	Boston	Chicago	SF	NYC	Seattle					
5	Boston	Chicago	SF	Seattle	NYC					
6	Boston	Chicago	Seattle	NYC	SF					
...	...	...	...	...	...	...	...	...	...	...
121	Seattle	SF	NYC	Chicago	Boston					
Sheet Name:		Distances	Routes							

**FR4.** Write a formula that can be placed into **F2** and then copied/pasted into **F2:I121** that finds the distance between the two cities. The values of the first ten cells that the formula must find (**F2:I3**) are already filled in for you as an example.

(20pts)

For a specific example, consider cell **H5**. **H5** must return the distance between **3→4**. In Row 5, **#3** (**C5**) and **#4** (**D5**) are **SF** and **Seattle**. Therefore, **H5** must return 808 (the distance between **SF** and **Seattle**, from the **Distances** sheet).

...answer this question on your free response answer sheet as question FR4.

**FR5.** Write a formula that can be placed into **J2** and then copied/pasted into **J2:J121** that finds the total distance of the specific route. The values of the first two cells that the formula must compute (**J2, J3**) are already filled in for you as an example.

(10pts)

...answer this question on your free response answer sheet as question FR5.

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