1. The data in the Excel spreadsheet linked below give the ages and salaries of the chief executive officers of 59 companies with sales between $5 million and $350 million.   The correlation between age and salary can be characterized as:

* 1.  Strong and positive.
* 2.  Strong and negative.
* 3.  Weak and positive.

4. Weak and negative.

|  |  |
| --- | --- |
| Age | Salary ($thousands) |
| 53 | 145 |
| 43 | 621 |
| 33 | 262 |
| 45 | 208 |
| 46 | 362 |
| 55 | 424 |
| 41 | 339 |
| 55 | 736 |
| 36 | 291 |
| 45 | 58 |
| 55 | 498 |
| 50 | 643 |
| 49 | 390 |
| 47 | 332 |
| 69 | 750 |
| 51 | 368 |
| 48 | 659 |
| 62 | 234 |
| 45 | 396 |
| 37 | 300 |
| 50 | 343 |
| 50 | 536 |
| 50 | 543 |
| 58 | 217 |
| 53 | 298 |
| 57 | 1103 |
| 53 | 406 |
| 61 | 254 |
| 47 | 862 |
| 56 | 204 |
| 44 | 206 |
| 46 | 250 |
| 58 | 21 |
| 48 | 298 |
| 38 | 350 |
| 74 | 800 |
| 60 | 726 |
| 32 | 370 |
| 51 | 536 |
| 50 | 291 |
| 40 | 808 |
| 61 | 543 |
| 63 | 149 |
| 56 | 350 |
| 45 | 242 |
| 61 | 198 |
| 70 | 213 |
| 59 | 296 |
| 57 | 317 |
| 69 | 482 |
| 44 | 155 |
| 56 | 802 |
| 50 | 200 |
| 56 | 282 |
| 43 | 573 |
| 48 | 388 |
| 52 | 250 |
| 62 | 396 |
| 48 | 572 |
|  |  |
|  |  |

2. A political consultant conducts a survey to determine what position the mayoral candidate she works for should take on a proposed smoking ban in restaurants.   Which of the following survey questions will deliver an unbiased response?

* 1. Should the city ban smoking in restaurants to protect our children from second-hand smoke?
* 2.  Should tobacco smoke, a known cause of lung cancer, be banned from public spaces such as restaurants?
* 3. Does the city have the right to restrict recreational activities, such as moderate consumption of alcohol or tobacco, on the premises of privately-owned businesses?

4. None of the above.

3. A nutrition researcher wants to determine the mean fat content of hen's eggs. She collects a sample of 40 eggs. She calculates a mean fat content of 23 grams, with a sample standard deviation of 8 grams. From these statistics she calculates a 90% confidence interval of [20.9 grams, 25.1 grams].   What can the researcher do to decrease the width of the confidence interval?

 1.  Increase the confidence level.

* 2. Decrease the confidence level.
* 3.  Decrease the sample size

4. None of the above.

4. In a random sample of 321 senior citizens, 61 were found to own a home computer.   Based on this sample, the 95% confidence interval for the proportion of computer-owners among senior citizens is:

* 1.  [2.6%; 7.4%].
* 2. [13.4%; 24.6%].
* 3.  [14.7%; 23.3%].

4. The answer cannot be determined from the information given.

5. Preliminary estimates suggest that about 58% of students at a state university favor implementing an honor code.   To obtain a 95% confidence interval for the proportion of all students at the university favoring the honor code, what is the minimum sample size needed if the **total** width of the confidence interval must be less than 5 percentage points (i.e., the confidence interval should extend at most 2.5 percentage points above and below the sample proportion)?

* 1.  375.
* 2.  264.
* 3. 1,498.

4. The answer cannot be determined from the information given.

6. In a survey of twelve Harbor Business School graduates, the mean starting salary was $93,000, with a standard deviation of $17,000.   The 95% confidence interval for the average starting salary among all Harbor graduates is:

* 1.  [$83,382; $102,618].
* 2. [$82,727; $103,327].
* 3.  [$82,199; $103,801].

 4. [$59,000; $127,000].

7. In a survey of 53 randomly selected patrons of a shopping mall, the mean amount of currency carried is $42, with a standard deviation of $78.   What is the 95% confidence interval for the mean amount of currency carried by mall patrons?

* [$39.1; $44.9].
* [$24.4; $59.6].
* [$21.0; $63.0].

 [$14.4; $69.6].

8. A filling machine in a brewery is designed to fill bottles with 355 ml of hard cider. In practice, however, volumes vary slightly from bottle to bottle. In a sample of 49 bottles, the mean volume of cider is found to be 354 ml, with a standard deviation of 3.5 ml.   At a significance level of 0.01, which conclusion can the brewer draw?

* 1. The true mean volume of all bottles filled is 354 ml.
* 2. The machine is not filling bottles to an average volume of 355 ml.
* 3.  There is not enough evidence to indicate that the machine is not filling bottles to an average volume of 355 ml.

4. The machine is filling bottles to an average volume of 355 ml.

9. To conduct a one-sided hypothesis test of the claim that houses located on corner lots (corner-lot houses) have higher average selling prices than those located on non-corner lots, the following alternative hypothesis should be used:

* 1.  The average selling price of a corner-lot house is higher than it is commonly believed to be.
* 2. The average selling price of a corner-lot house is higher than the average selling price of all houses.
* 3.  The average selling price of a corner-lot house is the same as the average selling price of a house not located on a corner lot.

4. The average selling price of a corner-lot house is higher than the average selling price of a house not located on a corner lot.

|  |  |
| --- | --- |
| **Corner-lot House Price (in $hundreds)** | **Non-corner Lot House Price (in $hundreds)** |
| 2150 | 2050 |
| 1999 | 2080 |
| 1800 | 2150 |
| 1375 | 1900 |
| 1250 | 1560 |
| 1110 | 1450 |
| 1139 | 1449 |
| 995 | 1270 |
| 900 | 1235 |
| 1695 | 1170 |
| 1553 | 1180 |
| 1300 | 1155 |
| 1020 | 995 |
| 1020 | 975 |
| 925 | 975 |
| 725 | 960 |
| 1299 | 860 |
| 1250 | 1250 |
| 1080 | 922 |
| 1050 | 899 |
| 835 | 850 |
| 805 | 876 |
| 750 | 890 |
| 773 | 870 |
| 1295 | 700 |
| 975 | 720 |
| 700 | 720 |
| 2100 | 749 |
| 600 | 731 |
| 1844 | 670 |
| 699 | 2150 |
| 1330 | 1599 |
| 1129 | 1350 |
| 1050 | 1239 |
| 1000 | 1200 |
| 1030 | 1125 |
| 940 | 1100 |
| 874 | 1049 |
| 766 | 955 |
| 739 | 934 |
| \* | 875 |
| \* | 889 |
| \* | 855 |
| \* | 810 |
| \* | 799 |
| \* | 759 |
| \* | 755 |
| \* | 750 |
| \* | 730 |
| \* | 729 |
| \* | 710 |
| \* | 690 |
| \* | 670 |
| \* | 619 |
| \* | 939 |
| \* | 820 |
| \* | 780 |
| \* | 770 |
| \* | 620 |
| \* | 540 |
| \* | 1070 |
| \* | 725 |
| \* | 660 |
| \* | 580 |
| \* | 1580 |
| \* | 1160 |
| \* | 1109 |
| \* | 1050 |
| \* | 1045 |
| \* | 1020 |
| \* | 975 |
| \* | 950 |
| \* | 920 |
| \* | 945 |
| \* | 872 |
| \* | 870 |
| \* | 869 |
|  |  |

10. The data in the Excel spreadsheet linked below indicate the selling prices of houses located on corner lots ("corner-lot houses") and of houses not located on corner lots.   Conduct a one-sided hypothesis test of the claim that corner-lot houses have higher average selling prices than those located on non-corner lots. Using a 99% confidence level, which of the following statements do the data support?

 1. Upscale, expensive neighborhoods have more street corners.

* 2. The average selling price of a corner-lot house is higher than that of the average house not located on a corner lot.
* 3. The average selling price of a corner-lot house is no more than that of the average house not located on a corner lot.

4. There is not enough evidence to support the claim that the average selling price of a corner-lot house is higher than that of the average house not located on a corner lot.

|  |  |
| --- | --- |
| **Corner-lot House Price (in $hundreds)** | **Non-corner Lot House Price (in $hundreds)** |
| 2150 | 2050 |
| 1999 | 2080 |
| 1800 | 2150 |
| 1375 | 1900 |
| 1250 | 1560 |
| 1110 | 1450 |
| 1139 | 1449 |
| 995 | 1270 |
| 900 | 1235 |
| 1695 | 1170 |
| 1553 | 1180 |
| 1300 | 1155 |
| 1020 | 995 |
| 1020 | 975 |
| 925 | 975 |
| 725 | 960 |
| 1299 | 860 |
| 1250 | 1250 |
| 1080 | 922 |
| 1050 | 899 |
| 835 | 850 |
| 805 | 876 |
| 750 | 890 |
| 773 | 870 |
| 1295 | 700 |
| 975 | 720 |
| 700 | 720 |
| 2100 | 749 |
| 600 | 731 |
| 1844 | 670 |
| 699 | 2150 |
| 1330 | 1599 |
| 1129 | 1350 |
| 1050 | 1239 |
| 1000 | 1200 |
| 1030 | 1125 |
| 940 | 1100 |
| 874 | 1049 |
| 766 | 955 |
| 739 | 934 |
| \* | 875 |
| \* | 889 |
| \* | 855 |
| \* | 810 |
| \* | 799 |
| \* | 759 |
| \* | 755 |
| \* | 750 |
| \* | 730 |
| \* | 729 |
| \* | 710 |
| \* | 690 |
| \* | 670 |
| \* | 619 |
| \* | 939 |
| \* | 820 |
| \* | 780 |
| \* | 770 |
| \* | 620 |
| \* | 540 |
| \* | 1070 |
| \* | 725 |
| \* | 660 |
| \* | 580 |
| \* | 1580 |
| \* | 1160 |
| \* | 1109 |
| \* | 1050 |
| \* | 1045 |
| \* | 1020 |
| \* | 975 |
| \* | 950 |
| \* | 920 |
| \* | 945 |
| \* | 872 |
| \* | 870 |
| \* | 869 |
|  |  |
|  |  |

11. Two semiconductor factories are being compared to see if there is a difference in the average defect rates of the chips they produce. In the first factory, 250 chips are sampled. In the second factory, 350 chips are sampled. The proportions of defective chips are 4.0% and 6.0%, respectively.   Using a confidence level of 95%, which of the following statements is supported by the data?

* 1. There is not sufficient evidence to show a significant difference in the average defect rates of the two factories.
* 2. There is a significant difference in the average defect rates of the two factories.
* 3. The first factory's average defect rate is lower than the second factory's on 95 out of 100 days of operation.

4. None of the above.

12. The regression analysis below relates average annual per capita beef consumption (in pounds) and the independent variable "average annual beef price" (in dollars per pound).   The coefficient on beef price tells us that:

[Beef Consumption and Price](https://eproduct.hbsp.harvard.edu/eproduct/product/quant/content/item/6175/beef.consump-price.xls)

* 1.  For every price increase of $1, average beef consumption decreases by 9.31 pounds.
* 2. For every price increase of $1, average beef consumption increases by 9.31 pounds.
* 3. For every price increase $9.31, average beef consumption decreases by 1 pound.

4. For price increase of $9.31, average beef consumption increases by 1 pound.

13. The regression analysis below relates average annual per capita beef consumption (in pounds) and the independent variable "average annual beef price" (in dollars per pound).   In a year in which the average price of beef is at $3.51 per pound, we can expect average annual per capita beef consumption to be approximately:

[Beef Consumption and Price](https://eproduct.hbsp.harvard.edu/eproduct/product/quant/content/item/6175/beef.consump-price.xls)



* 1.  55.2 pounds
* 2.  52.6 pounds
* 3.  53.6 pounds

4. 117.9 pounds

14. The regression analysis below relates average annual per capita beef consumption (in pounds) and the independent variable "average annual per capita pork consumption" (in pounds).   At what level is the coefficient of the independent variable pork consumption significant?

[Beef Consumption and Pork Consumption](https://eproduct.hbsp.harvard.edu/eproduct/product/quant/content/item/6175/beef.consump-pork.xls)

[Source](https://eproduct.hbsp.harvard.edu/eproduct/product/quant/content/item/6175/source_bibliography.xls)



* 1.  0.10.
* 2.  0.05.
* 3.  0.01.

4.  None of the above.

15. The regression analysis below relates average annual per capita beef consumption (in pounds) and the independent variable "average annual per capita pork consumption" (in pounds).   Which of the following statements is true?

[Beef Consumption and Pork Consumption](https://eproduct.hbsp.harvard.edu/eproduct/product/quant/content/item/6175/beef.consump-pork.xls)

[Source](https://eproduct.hbsp.harvard.edu/eproduct/product/quant/content/item/6175/source_bibliography.xls)



* 1.  Beef consumption can never be less than 65.09 pounds.
* 2. Beef consumption can never be greater than 65.09 pounds.
* 3.  The y-intercept of the regression line is 65.09 pounds.

4.  The x-intercept of the regression line is 65.09 pounds.

16. The regression analysis at the bottom relates average annual per capita beef consumption (in pounds) and the independent variables "average annual per capita pork consumption" (in pounds) and "average annual beef price" (in dollars per pound).   Which of the independent variables is significant at the 0.01 level?

[Beef Consumption, Pork Consumption, and Beef Price](https://eproduct.hbsp.harvard.edu/eproduct/product/quant/content/item/6175/beef.consump-price-pork.xls)

[Source](https://eproduct.hbsp.harvard.edu/eproduct/product/quant/content/item/6175/source_bibliography.xls)



* 1. Beef price only.
* 2. Pork consumption only.
* 3. Both independent variables.

4.  Neither independent variable