Week 1 - AYU - Individual

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### Type 1: Calculating parameter estimators form the sums.

**Problem 1.**

Determine which of the following statements is NOT true about the equation

1. is the expected value of Y.
2. is the average increase in Y associated with a one-unit increase in X.
3. The error term, , is typically assumed to be independent of X .
4. The equation defines the population regression line.
5. The method of least squares is commonly used to estimate the coefficients and .

**Problem 2.**

| x | 2 | 3 | 5 | 6 | 1 | 9 | 10 | 15 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| y | 1 | 4 | 6 | 4 | 4 | 3 | 20 | 25 |

Write the equation of the best fitted line.

A.   
B.   
C.   
D.   
E.

**Problem 3.** (SRM - Sample Question 17)

The regression model is . There are six observations. The summary statistics are:

Calculate the least squares estimate of .

1. 0.1
2. 0.3
3. 0.5
4. 0.7
5. 0.9

**Problem 4**

The regression model is . You are given the follows.

Predict given that

A. 63.748  
B. 62.758  
C. 64.758  
D. 65.758  
E. The correct answer is not given by (A), (B), (C), or (D).

**Problem 5** (SRM - Sample Question 11) You are given the following results from a regression model.

| Observation number (i) |  |  |
| --- | --- | --- |
| 1 | 2 | 4 |
| 2 | 5 | 3 |
| 3 | 6 | 9 |
| 4 | 8 | 3 |
| 5 | 4 | 6 |

Calculate the sum of squared errors (SSE).

1. -35
2. -5
3. 5
4. 35
5. 46

**Problem 6** (SRM - Sample Question 18) For a simple linear regression model the sum of squares of the residuals is

and the statistic is 0.64. Calculate the total sum of squares (TSS) for this model.

1. 605.94
2. 638.89
3. 690.77
4. 701.59
5. 750.87

**Problem 7** (SRM - Sample Question 47)

You are given the following summary statistics:

Determine the equation of the regression line, using the least squares method.

1. The correct answer is not given by (A), (B), (C), or (D).

### Type 2: Statistical Inference: Hypothesis Testing

**Problem 8** (Calculating t-statistics given a summarized output)

Calculate the t-value of a linear regression model, , given that

A. 2  
B. 4  
C. 7  
D. 10  
E. 13

**Problem 9** (SRM - Sample Question 44)

Two actuaries are analyzing dental claims for a group of participants. The predictor variable is sex, with 0 and 1 as possible values.

Actuary 1 uses the following regression model:

Actuary 2 uses the following regression model:

The residual sum of squares for the regression of Actuary 2 is 250,000 and the total sum of squares is 490,000.

Calculate the F-statistic to test whether the model of Actuary 2 is a significant improvement over the model of Actuary 1.

1. 92
2. 93
3. 94
4. 95
5. 96

**Problem 10** (t-test)

The results of fitting ten observation by the regression model, , are given below.

Determine the test results of the hypothesis against .

|  | Estimate | Std. Error | t value | Pr(>|t|) |
| --- | --- | --- | --- | --- |
| Intercept | -4.4916 | 6.6540 | -0.675 | 0.51869 |
| x | 3.4122 | 0.7638 | 4.468 | 0.00209 |

A. Reject at   
B. Reject at   
C. Reject at   
D. Reject at   
E. All (A), (B), (C), or (D) are correct.

**Problem 11** (F-test)

The results of fitting ten observation by the regression model, , are given below.

Determine the p-value of the F-test for against .

|  | Estimate | Std. Error | t value | Pr(>|t|) |
| --- | --- | --- | --- | --- |
| Intercept | 3.30000 | 1.39766 | 2.361 | 0.0776 |
| x | 0.08462 | 0.27410 | 0.309 | 0.7730 |

Problem (F-test)

A. p-value of the F-test is not given in the result  
B. p-value = 0.0776  
C. p-value = 0.7730  
D. p-value =   
E. The correct answer is not given by (A), (B), (C), or (D).

### Type 3: Statistical Inference: Confidence Intervals and prediction Interval

**Problem 12** (SRM - Sample Question 13)

In a simple linear regression model based on over 100 observations, you are given the following estimates.

1. The estimated slope is –1.03.
2. The standard error of the estimated slope is 0.06.

Calculate the 95% confidence interval for the slope.

1. (–1.15, –0.91)
2. (–1.13, –0.93)
3. (–1.11, –0.95)
4. (–1.09, –0.97)
5. (–1.07, –0.99)

**Problem 13** (SRM - Sample Question 13) Determine which of the following statements is/are true for a simple linear relationship,

* I. If , the 95% confidence interval is equal to the 95% prediction interval
  1. The prediction interval is always at least as wide as the confidence interval.
  2. The prediction interval quantifies the possible range for

1. I only
2. II only
3. III only
4. I, II, and III
5. The correct answer is not given by (A), (B), (C), or (D)

**Problem 14** (SRM - Sample Question 56)

Determine which of the following statements about prediction is true.

1. Each of several candidate regression models must produce the same prediction.
2. When making predictions, it is assumed that the new observation follows the same model as the one used in the sample.
3. A point prediction is more reliable than an interval prediction.
4. A wider prediction interval is more informative than a narrower prediction interval.
5. A prediction interval should not contain the single point prediction

### Type 4: Application of Linear Model.

**Problem 15** (SRM - Sample Question 23)

Toby observes the following coffee prices in his company cafeteria:

* 12 ounces for 1.00
* 16 ounces for 1.20
* 20 ounces for 1.40

The cafeteria announces that they will begin to sell any amount of coffee for a price that is the value predicted by a simple linear regression using least squares of the current prices on size.

Toby and his co-worker Karen want to determine how much they would save each day, using the new pricing, if, instead of each buying a 24-ounce coffee, they bought a 48- ounce coffee and shared it.

Calculate the amount they would save.

1. It would cost them 0.40 more.
2. It would cost the same.
3. They would save 0.40.
4. They would save 0.80.
5. They would save 1.20.

**Problem 16** (SRM - Sample Question 23)

Peter observes the following coffee prices in his company cafeteria:

* 1 bagel for 1.00 (USD)
* 2 bagel for 1.50 (USD)

The cafeteria announces that they will begin to sell any amount of bagels for a price that is the value predicted by a simple linear regression using least squares of the current prices.

With the new pricing model, how much Peter would save if he bought 10 bagels instead of 5 bagels twice?

1. It would cost him more so he would not save any money.
2. It would cost the same.
3. He would save 0.5 (USD)
4. He would save 1 (USD)
5. He would save 1.5 (USD)