MATH-1110 (DUPRÉ) FALL 2018 TEST 2 ANSWERS

1. PRINT YOUR LAST NAME IN THE UPPER RIGHT CORNER IN LARGE CAPITAL LETTERS.

2. PRINT YOUR FIRST NAME UNDERNEATH YOUR LAST NAME IN THE UPPER RIGHT CORNER IN CAPITAL LETTERS.

3. PRINT YOUR LAB DAY AND LAB START TIME UNDERNEATH YOUR FIRST NAME IN THE UPPER RIGHT CORNER.

4. WRITE YOUR MATH-1110 COURSE AND SECTION NUMBER UNDERNEATH YOUR LAB DAY IN THE UPPER RIGHT CORNER.

The remaining problems all use the information that follows. Suppose that Joe has an aquarium tank containing many fish. For any fish selected, we let X denote the LENGTH of the fish in millimeters and W the WEIGHT of the fish in grams. Joe tells his friend Sam that the fish in his tank have an average length of 80 millimeters with a standard deviation of 10 millimeters, and that the average weight of the fish is 90 grams with a standard deviation of 5 grams. Joe also tells Sam that the correlation coefficient of length and weight is 0.8. Suppose that Joe has selected two fish from the aquarium, one after another, without letting Sam see which fish he selected, and placed the fish in a smaller holding tank for observation. Let the unknown W_1 be the weight of the first fish Joe has selected from the aquarium, which Sam does not know, and henceforth called "the first fish". Let W_2 be the weight of the second fish Joe selected and henceforth known as "the second fish". Likewise, let the unknown X_1 be the length of the first fish, and likewise, let X_2 be the length of the second fish.

5. Without knowing the LENGTH of the first fish Joe selected, what should Sam expect to be its WEIGHT?

ANSWER: 90

6. Without knowing the LENGTH of the second fish, what should Sam expect to be its WEIGHT?

ANSWER: 90

7. Without knowing the LENGTH of either fish, what should Sam expect to be the AVERAGE WEIGHT of the two fish that Joe selected from the aquarium?

ANSWER: 90

8. Without knowing the length of the first fish, what should Sam expect for his squared error in his expected WEIGHT of the first fish?

ANSWER: $5^2 = 25$

9. If the first fish is 96 millimeters long, what is its STANDARDIZED LENGTH score?

ANSWER: $[96 - 80]/10 = 1.6$

10. If the first fish has a STANDARDIZED WEIGHT score of -1.2, then what is its RAW WEIGHT score, that is its weight in grams?

ANSWER: $90 + [(5)(-1.2)] = 90 - 6 = 84$

11. If Sam is told that the second fish is 80 millimeters LONG, then what should Sam expect for the WEIGHT of the second fish, using SIMPLE LINEAR REGRESSION in view of the given correlation of length and weight?

ANSWER: 90

12. If Sam is told that the first fish is 96 millimeters LONG, then what should Sam expect for the WEIGHT of the first fish, using SIMPLE LINEAR REGRESSION in view of the given correlation of length and weight?

ANSWER: $80 + [(5)(.8)[(96 - 80)/(10)]] = 80 + (4)(1.6) = 80 + 6.4 = 86.4$

13. In the previous two cases where Sam knew the lengths of the two fish, what should Sam expect is his squared error in his expected value for the WEIGHT of the fish when using SIMPLE LINEAR REGRESSION and the correlation of length and weight to determine what WEIGHT to expect by using the LENGTH?

ANSWER: $(25)[1 - (.8)^2] = (25)[1 - .64) = (25)(.36) = (1/4)(36) = 9$

14. What is the percentage of reduction in expected squared error in expected WEIGHT when using SIMPLE LINEAR REGRESSION and the correlation of LENGTH with WEIGHT to calculate expected WEIGHTS for fish in the aquarium?

ANSWER: 8^2 **percent** $= 64$ **percent**

15. What is the VARIANCE of X?

ANSWER: $(10)^2 = 100$

16. What is the VARIANCE of W?

ANSWER: $5^2 = 25$

17. What is the covariance of X with W, that is, what is $Cov(X, W)$?

ANSWER: $Cov(X, W) = \rho\sigma_X\sigma_W = (.8)(10)(5) = 40$

18. If $Y = X + W$, then what is the variance of Y?

ANSWER: $(10)^2 + 5^2 + 2(.8)(10)(5) = 100 + 25 + 80 = 205$

19. If $R = X - W$, then what is the VARIANCE of R?

ANSWER: $(10)^2 + 5^2 - 2(.8)(10)(5) = 100 + 25 - 80 = 45$

20. What is the covariance of $2X - 7$ with $W - 23$?

ANSWER: $(2)Cov(X, W) = (2)(.8)(10)(5) = (2)(40) = 80$