Math 3339
Review for Final Exam - KEY

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1. c. The interquartile range increases.
2. 0.003348589
3. --
4. b_0 = y-intercept and b_1= slope. Which of these will best explain the relationship between x and y? b_1
5. --
6. d . Deciding to go for the first down when his team will not get the first down.
7. 15/43
8. 9/20
9. a. [17.01, 26.79]
   b. [29.75313, 170.9206]
10. $$P\left(Z < \frac{\left(7020/52\right) - 140}{10/\sqrt{52}}\right)$$
11. b. two-sample t-test for means
12. new mean = 5.64, new s=1.32
13. E[X] = 3.2, V[X] = 1.76
14. Median = 3.5 kg, shape is skewed right
15. b. A and C have reasonable intervals, but B does not.
16. [0.621, 0.779]
17. a. Fail to reject H_0 at $\alpha = 0.05$
    $H_0 : \mu = 33.5$
    $H_a : \mu \neq 33.5$
    $$t = \frac{31.6 - 33.5}{3.4/\sqrt{12}} = -1.936$$
    $$p(t \neq -1.936) = 2 \cdot p(t < -1.936) = 0.07897696$$
    b. Reject H_0 at $\alpha = 0.05$
    $H_0 : \mu = 33.5$
    $H_a : \mu < 33.5$
    $$t = \frac{31.6 - 33.5}{3.4/\sqrt{12}} = -1.936$$
    $$p(t < -1.936) = p(t < -1.936) = 0.03948848$$
    c. two-sided t test vs. one-sided t test.
18. a. 1/4 b. 3/4
19. a. $\hat{y} = -0.9644 + 0.0105x$ b. $\hat{y} = 0.5742 + 0.0137x$ c. IT (higher R^2 and lower p-value)

20. a. np=2, too small
    b. since np and n(1-p) must each be at least 10, we will need 500 parts to sample
    c. Fail to reject H_0 at $\alpha = 0.05$

$$H_0 : \rho = 0.02 \qquad H_0 : \rho = 0.02$$

$$H_a : \rho \neq 0.02 \qquad H_a : \rho > 0.02$$

$$z = \frac{.03 - .02}{\sqrt{.02(.98)/500}} = 1.597 \qquad z = \frac{.03 - .02}{\sqrt{.02(.98)/500}} = 1.597$$

$$p(z \neq 1.597) = 2 \cdot p(z > 1.597) = 0.1102657 \quad p(z > 1.597) = 0.05513285$$

21. Fail to reject the null hypothesis. (this is a two sided proportions test, the test statistic is 0.3333 which does not fall in the rejection region for 1% significance)
22. Reject H_0 at $\alpha = 0.05$

$$H_0 : \mu = 32$$

$$H_a : \mu \neq 32$$

$$t = \frac{35 - 32}{5/\sqrt{64}} = 4.8$$

$$p(t \neq 4.8) = 2 \cdot p(t > 4.8) = 1.014185\text{e-}05$$

23. (two sample z test since we have population sd)
    test statistic is z=-7.28 => Reject the null and conclude there is a difference in the means.
24. 0.420117
25. -0.5244005
26. 0.0306
27. 1.396815
28. 0.02550163
29. 1537
30. matched pairs t-test. Reject the null hypothesis

$$H_0 : \mu_D = 0$$

$$H_a : \mu_D > 0$$

$$t = \frac{33.3}{26.39044/\sqrt{10}} = 3.99$$

$$p(t > 3.99) = 0.001578866$$

31. a. success/fail, same prob for success, independent trials
    b. dbinom(4,6,.9)=0.098415
    c. pbinom(2,6,.9)=0.00127
    d. 1-pbinom(4,6,.9)=0.885735 (remember, this is discrete data)
32. for $H_a : \textit{not all same}$, based on p-value given for data, reject the null at 5%
33. $\int_0^a \frac{1}{2}x^2 dx = \frac{1}{6}x^3\Big|_0^a = \frac{1}{6}a^3 = 1 \rightarrow a = \sqrt[3]{6}$
34. 98

35. Fail to reject the null hypothesis

$$H_0: \mu_g = \mu_b$$

$$H_a: \mu_g \neq \mu_b$$

$$t = \frac{18.56 - 17.95}{\sqrt{\frac{4.35^2}{65} + \frac{4.87^2}{75}}} = 0.783$$

$$p(t \neq 0.783) = 2 \cdot p(t > 0.783) = 0.436515$$

36. a. f = MSTr/MSE = 9.722

b. p-value=1-pf(9.722,3, 16)= 0.000685104; Reject H_0; Pairs that differ significantly will have w = qtukey(.95,4,16)*sqrt(1.331/5)=2.087564; (1,2), (1,3), (4,2), (4,3)

37. Reject H_0

$$H_0: \rho_r = \rho_n$$

$$H_a: \rho_r > \rho_n$$

$$z = \frac{.7 - .4}{\sqrt{\frac{86}{140}\left(\frac{54}{140}\right)\left(\frac{1}{100} + \frac{1}{40}\right)}} = 3.29$$

$$p(z > 3.29) = 0.0005009369$$

38. Reject H_0

$$H_0: \rho = 0.8$$

$$H_a: \rho < .8$$

$$z = \frac{\frac{77}{110} - .8}{\sqrt{.8(.2)/110}} = -2.622$$

$$p(z < -2.622) = 0.004370772$$

39. Reject the null hypothesis

$$H_0: \mu_1 = \mu_2$$

$$H_a: \mu_1 > \mu_2$$

$$t = \frac{85 - 83}{\sqrt{\frac{3^2}{75} + \frac{2^2}{60}}} = 4.629 \ (use\ df = 59)$$

$$p(t > 4.629) = 1.032084\text{e-}05$$

40. a. $\hat{y} = -46.425 + 1.158x$ r = .9255 $r^2 = .8566$

b. b = 1.158 $t^* = 1.860$ $SE_b = .1676$

$$b \pm t^* SE_b$$

$$1.158 \pm 1.860 \cdot .1676$$

$$(.846, 1.467)$$

This means that I am 90% confident the true slope of the LSRL of math and verbal scores on the SAT will lie in this interval. OR: I am 90% confident that for every 1 point increase in math SAT score, the average increase in verbal SAT score will be between .846 and 1.467.

c.

$$H_0: \beta = 0 \qquad H_a: \beta \neq 0$$

$$t = 6.912$$

$$P(b \neq 0) = P(t \neq 6.912) = 0.000123$$

Conclusion: Based on 5% significance level, I will reject the null hypothesis which states that there is no linear relationship between math and verbal scores on the SAT.

41. a. $\hat{y} = 12.96 + 4.0162x$

b. On average, for each 1 point increase in the problem solving sub score, the was an increase of 4.0162 points in the total score.

c. R^2 indicates that 62% of the variation in total scores can be explained by the LSRL of total scores on problem solving sub score.

d.

$$n = 36 \Rightarrow df = 34 \Rightarrow t^* = 2.032$$

$$b \pm t^* SE_b$$

$$4.0162 \pm 2.032 \cdot .5393$$

$$(2.920, 5.112)$$

e. All assumptions check.

$$H_0: \beta = 0 \qquad H_a: \beta \neq 0$$

$$t = 7.45 \text{ from printout}$$

$$t = \frac{4.0162}{.5393} \text{ formula}$$

$$P(b \neq 0) = P(t \neq 7.45) = 0.000$$

$$6.0613 \times 10^{-9} \text{ using tcdf on calculator}$$

Based on 5% significance level I will reject the null hypothesis which states that there is no linear relationship between problem solving sub scores and total scores on the exam.