NAME:

section 9.2 Exercises

Better parking A local high school makes a change that should improve student satisfaction with the parking situation. Before the change, 37% of the school's students approved of the parking that was provided. After the change, the principal surveys an SRS of 200 of the over 2500 students at the school. In all, 83 students say that they approve of the new parking arrangement. The principal cites this as evidence that the change was effective. Perform a test of the principal's claim at the $\alpha = 0.05$ significance level.

COMPLETE TEST OF STATISTICS TEM PLATE

43) Better parking Refer to Exercise 41.
(a) Describe a Type I error and a Type II error in this setting, and explain the consequences of each.
(b) The test has a power of 0.75 to detect that p = 0.45. Explain what this means.

(c) Identify two ways to increase the power in part (b)

45 Are boys more likely? We hear that newborn babies are more likely to be boys than girls. Is this true? A random sample of 25,468 firstborn children included 13,173 boys.¹³ Boys do make up more than half of the sample, but of course we don't expect a perfect 50-50 split in a random sample.

(a) To what population can the results of this study be generalized: all children or all firstborn children? Justify your answer.

SINCE THE STUDY WAS A RANDOM SAMPLE OF FIRST BORN CHILDREN, RESULTS CAN ONLY BE GENERALIZED TO FIRST BORNS.

(b) Do these data give convincing evidence that boys are more common than girls in the population? Carry out a significance test to help answer this question.

COMPLETE TEST OF STATISTICS TEMPLATE

| & SPECIAL INSTRUCTIONS * * |
|---|
| () You will need 3 of the forms |
| " TEST OF STATISTICS TEMPLATE " |
| BLANK COPIES ARE ONLINE |
| ANSWER TO # 43 HERE |
| [42A] |
| TNDS T ERROR Anglado that mus |
| THE I ENCOR. CONCLUDE FALL More |
| then 31% of sudents were |
| Schistica with the new porking |
| Caly 370 were satisfied |
| Consequence: the principal believes |
| that students are satisfied and |
| takes no further action |
| Type II ERROR: Say that we do not have |
| enough evidence to conclude that |
| mored than 37% are satisfied with |
| the parking arrangements when in the |
| more thin 307% are schisticd. |
| Consequences The principal takes further |
| action on parking when none is needed. |
| 43B IF P=,045 THE PRUBABILITY OF |
| CREEFERTING REJECTING the null hypothesis |
| 15.75 Ho |
| & x=.05 |
| Puelue= ,093 |
| .37 |
| 2 5.25 power |
| D X is |
| .45 |
| |
| 1430 TWO WAYS TO INCREASE |
| Power |
| O THERE THE SAMPLE SIZE |
| O THE SIGNIFICANCE |
| (d) INCREASE THE |
| LEVEL (~) |
| |
| |

[49] Teen drivers A state's Division of Motor Vehicles 149 (DMV) claims that 60% of teens pass their driving test on the first attempt. An investigative reporter COMPLETE TEST OF STATISTICS examines an SRS of the DMV records for 125 teens; 86 of them passed the test on their first try. Is this TEMPLATE good evidence that the DMV's claim is incorrect? Carry out a test at the $\alpha = 0.05$ significance level to help answer this question. Conditions () Teens rundomly selected 51. Teen drivers Refer to Exercise 49. Independent - Population mure (a) Construct and interpret a 95% confidence interval for the proportion of all teens in the state who then 1,250 passed their driving test on the first attempt. NOTE · CALCULATE BY HAND CIUSE (3) Normali 86 successes (np) and 1688 · CHECK WITH TI 84 AND WRITE Simple 39 failures (ng) are both Statistic CALCULATOR COMMAND. n=125 greater than 10 · Remember to check conditions 7*=1.96 CI : one simple Zinteruch for p with Colc CALC CI Pt P'E 2 2 louiste 95% CI A: | PROP ZINTERVAL TESTS STAT X=86 n=125 C-Level=,95 (1688)(1312 → (,60678,.76922) 1688 ± 1.96 (.0414) Conclusion We are 95% confident .688 ± .081 (.607, .769) that the interval , 607 to , 769 Captors the true proportion of teens who pass their driving test on their first try (b) Explain what the interval in part (a) tells you about the DMV's claim. The 95% confidence interval We calculated based on the Sample distribution does NOT Contain 0.60 as a plausible U due of P, Which gives convincing evidence against the Dmvis Claim,

9.2

53 Do you Twitter? In late 2009, the Pew Internet and American Life Project asked a random sample of U.S. adults, "Do you ever . . . use Twitter or another service to share updates about yourself or to see updates about others?" According to Pew, the resulting 95% confidence interval is (0.167, 0.213).¹⁵ Can we use this interval to conclude that the actual proportion of U.S. adults who would say they Twitter differs from 0.20? Justify your answer. AN SUGR BELOW

The 95% Confidence interval is (1167,213).

We can not justify the 20 diffes Since it is included in the interval

55] Teens and sex The Gallup Youth Survey asked a random sample of U.S. teens aged 13 to 17 whether they thought that young people should wait to have sex until marriage.¹⁷ The Minitab output below shows the results of a significance test and a 95% confidence interval based on the survey data.



(a) Define the parameter of interest.

(b) Check that the conditions for performing the significance test are met in this case.

(c) Interpret the P-value in context.

(d) Do these data give convincing evidence that the actual population proportion differs from 0.5? Justify your answer with appropriate evidence.

COMPLETE Templete TEST

#41

9.2

Test of Significance Template

| Parameter of | D=actual proportion of students who are | | | | |
|--|---|--|--|--|--|
| Interest | satisfied with the parking situation | | | | |
| Choice of Test | ONE-SAMPLE Z TEST FOR P | | | | |
| Level of Significance | \$ =.05 | | | | |
| Null | English: | | | | |
| Hypothesis | Symbols: H_o : $D = .37$ | | | | |
| Alternative | English: | | | | |
| Hypothesis | symbols: HA: P 7.37 (interested in improved setisfee | | | | |
| | 1) The students were rendomly selected | | | | |
| Conditions of | (2) Independent - There are 200 sempled and since there are | | | | |
| Toof | 2,500 students in the H.S; the 10 % condition is met. | | | | |
| TCSL TFT | 3 Normal Condition was met: np= 200(.37) = 747,10/ | | | | |
| | ng = 200(163) = 1267101 | | | | |
| | Sketch of the sampling distribution of the sample statistic under the null hypothesis, indicating | | | | |
| | the mean: | | | | |
| Sampling | X=83 approved | | | | |
| Distribution | N= 200 | | | | |
| | P=8 1/200 =.415 .37 P | | | | |
| | Formula: Plug-ins & Value: | | | | |
| Test Statistic | $Z = \frac{P - P}{\sqrt{P_{g}/h}} \qquad P = .37 \qquad h = 200 \qquad Z = \frac{11 - 200}{\sqrt{(.37)(.63)}} = \frac{.045}{.0341} = 1.7$ | | | | |
| P-value | Use correct probability notation. | | | | |
| | P(Z71.32) = normal cdf (1.32, E99, 0,1) = .093 | | | | |
| Meaning of | Since P= 1093 > d= 105, We tail to reject to | | | | |
| the P-value | | | | | |
| | Reject null hypothesis Significant result | | | | |
| | Fail to reject null hypothesis 🔲 Not Significant result | | | | |
| | English: | | | | |
| Conclusions | SINCE OUR pullue is greater than ,05, we full to | | | | |
| | reject the null hypothesis. We do not have evidence | | | | |
| and a second of the second second second | to conclude that the new perking arrangement | | | | |
| | increased student Schisfaction with | | | | |
| | Porking at this school | | | | |



Test of Significance Template

| Parameter of Interest | P = actual proportion boys who were first born children | | | | |
|--------------------------|---|--|--|--|--|
| Choice of Test | ONE SAMPLE ZTEST FOR P | | | | |
| Level of Significance | 2=:05 (Since no 2 WAS GIVEN) | | | | |
| Null | English: | | | | |
| Hypothesis | Symbols: H_0 ; $P = .5$ | | | | |
| Alternative | English: | | | | |
| Hypothesis | Symbols: 4A: P 7.5 | | | | |
| | () random sample of first born children | | | | |
| Conditions of | 2) Independent: Recouncille there are 25,468(10) = 254,680 | | | | |
| Test | 3 Normal condition mes: | | | | |
| | np=25468(15)=12,734>,10 ng=25468(15)=12,734>,10 | | | | |
| | Sketch of the sampling distribution of the sample statistic under the null hypothesis, indicating | | | | |
| Sampling | the mean: Y = (3, 12, B, ov) | | | | |
| Distribution | n= 25 468 P | | | | |
| | P=.517 .517 | | | | |
| | Formula: Plug-ins & Value: .517-,5 ,017 | | | | |
| Test Statistic | $Z = \frac{P - P}{\sqrt{Pg/h}}$ $P = .5 = 25,468$ $Z = \sqrt{\frac{(.5)(.5)}{.5468}} = .0031 = 5.4$ | | | | |
| P value | Use correct probability notation. | | | | |
| r-value | P(Z> 5,48)=Normakedf(5,48, E94, 0,1) = 0 | | | | |
| Meaning of | PLA | | | | |
| the P-value | 0 < .05 Reject Ho | | | | |
| Jun . | Reject null hypothesis | | | | |
| | Fail to reject null hypothesis Not Significant result | | | | |
| Conclusions | English: | | | | |
| | Since our puclue is extremely small and less than | | | | |
| | , os significance level, we reject the null hypothesis. | | | | |
| | It appears that boys are more prevalent | | | | |
| | amony first burn children. | | | | |



Test of Significance Template

| (| Parameter of | "D= and 1 paration at the pass their driving test |
|--|----------------------------------|---|
| | Interest Choice of | on the first attempt |
| | Test Level of Significance | d =.05 |
| 658 25 | _Null Hypothesis | English: Symbols: $H_{0} = D = 60$ |
| ESTS $R_{ab}^{ab} e^{b}$ $R_{ab}^{ab} e^{b}$ $R_$ | Alternative Hypothesis | English: Symbols: H_{q} : $P \neq .60$ |
| | Conditions of | 1) SRS of DMV records for 125 teens 2) Independent - I tis reconcible to think there were |
| | Test | 3 Normal met - np=(ias)(.6) = 757.107 $ny=(ias)(.4) = 507.10$ |
| | Sampling Distribution | Sketch of the sampling distribution of the sample statistic under the null hypothesis, indicating the mean: $X = 86 p_{4.55e} d$ n = 125 P = .688 P = .688 |
| | Test Statistic | Formula: |
| | P-value | Use correct probability notation. $P(Z \leq 2.01) \circ R P(Z^{2}, 2.0) = 2(numel cdf(2.01, E99, 0, 1)) = 2(.022) = .04$ |
| | Meaning of the P-value | P(1044) L 2 (105) Reject Ho |
| Nay an | | Reject null hypothesis |
| STAT 5:1 | | Fail to reject null hypothesis O Not Significant result |
| | Conclusions | English: Since the puche is less thin is, we |
| | | then 160 of teens Dess the driving test |
| | | on their first attempt. Since this is it is |
| | 703 | a 2 tail test the proportion could be |
| (or c | 6 min | above or below, 6, |

Test of Significance Template

| Parameter of Interest | P= the true proportion of teens who think that young people should wait to have sex until marriage | | | |
|--------------------------|---|--|--|--|
| Choice of Test | One sample Z test for P | | | |
| Level of Significance | d = ,05 | | | |
| Null | English: | | | |
| Hypothesis | Symbols: $H_0: p = .5$ | | | |
| Alternative | English: Note: Can only find CI | | | |
| Hypothesis | Symbols: HA: PF.5 For 2 teil tests. | | | |
| | () Rendom Sample 439 US teens 13-17 | | | |
| Conditions of | 2 Independent - The population of us Teens is | | | |
| Test | greater than 4,390 (439.10) | | | |
| | (3) normal condition men np = 439 (15) = 219.5 -10 ng = 439 (5) = 219.5 -10 | | | |
| | Sketch of the sampling distribution of the sample statistic under the null hypothesis, indicating | | | |
| Sampling | the mean: $P = 006$ | | | |
| Distribution | The the | | | |
| | 15 | | | |
| Test Statistic | Formula: P = P P = 15 $Q = 15P = 15$ $Q = 15$ $P = 15$ $Q = 15P = 15$ $Q = 15$ $P = 15$ $P = 15$ $Q = 15$ $P = 15$ | | | |
| P-value | Use correct probability notation. $P(Z \le -2.51) \circ P(Z >, 2.51) = Normal cdf(2.51, E99, 0, 1) = .00L \times 2$ | | | |
| Meaning of | since pis smaller than & Reject to (P=,012) | | | |
| the P-value | 1012 2,05 | | | |
| 2 pt | Reject null hypothesis Significant result | | | |
| | Fail to reject null hypothesis Not Significant result | | | |
| Conclusions | Since the puclue is less thin d=.05, Reject Ho. | | | |
| | We conclude that the actual proportion of teens | | | |
| | Who think that young people should wait | | | |
| | is not .50, | | | |

9.2