MACQUARIE University

This question paper must be returned. Candidates are not permitted to remove any part of it from the examination room.

SEAT NUMBER: …… ROOM:……

FAMILY NAME:……..……

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STUDENT NUMBER:…..……..……..

FORMAL EXAMINATION PERIOD: SESSION 2, NOVEMBER 2016

Unit Code:	STAT170
Unit Name:	Introductory Statistics
Duration of Exam (including reading time if applicable)**:**	Two (2) hours plus 10 minutes reading time
Total No. of Questions:	7
Total No. of Pages (including this cover sheet)**:**	20

GENERAL INSTRUCTIONS TO STUDENTS:

- Students are required to follow directions given by the Final Examination Supervisor and must refrain from communicating in any way with another student once they have entered the final examination venue.
- Students may not write or mark the exam materials in any way during reading time.
- Students may only access authorised materials during this examination. A list of authorised material is available on this cover sheet.
- All watches must be removed and placed at the top of the exam desk and must remain there for the duration of the exam. All alarms, notifications and alerts must be switched off.
- Students are not permitted to leave a final examination venue during the last 15 minutes of the examination.
- If it is alleged you have breached these rules at any time during the examination, the matter may be reported to a University Discipline Committee for determination.

EXAMINATION INSTRUCTIONS:

Please print your name and student number on this booklet.

All questions should be attempted. Answers to all questions should be written in the spaces provided. The reverse sides of the pages may be used for rough working.

The total mark for each question is shown in brackets next to the question number.

Statistical tables and formulas are given at the end of this booklet.

MATERIALS PERMITTED/NOT PERMITTED:

Dictionaries:
No dictionaries are permitted.

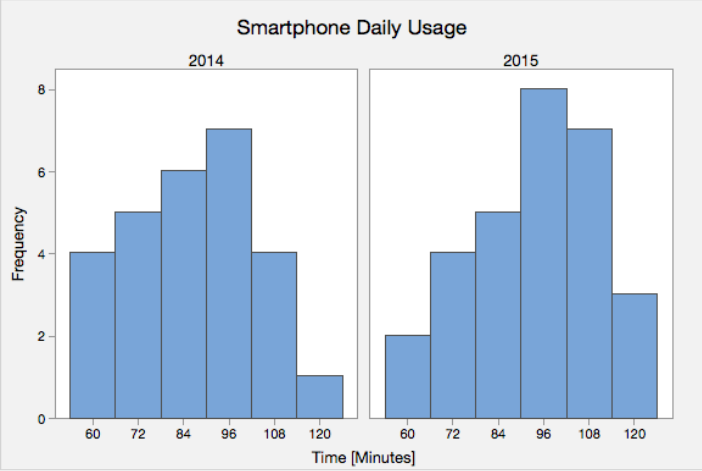
Calculators:
Calculators are permitted (any type).

Other:
Closed book with specified materials permitted: 1 x A4 sheet of handwritten notes (double-sided) permitted. Notes to be collected with exam paper at end of exam by placing it inside this booklet.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Total
8	**9**	**9**	**14**	**16**	**7**	**7**	**70**

Questions 1 and 2 are based on the study described below:

MQ Marketing Services is interested in mobile technology usage. A study was undertaken in which a random sample of 35 students enrolled at Macquarie University in each of 2014 and 2015 were been invited to take part in a project about the use of smartphones among students. There were 27 students in 2014 and 29 students in 2015 who participated in the study. The results relative to their daily usage are reported below, together with some relevant summaries. Use the appropriate parts of this information to answer the questions which follow.



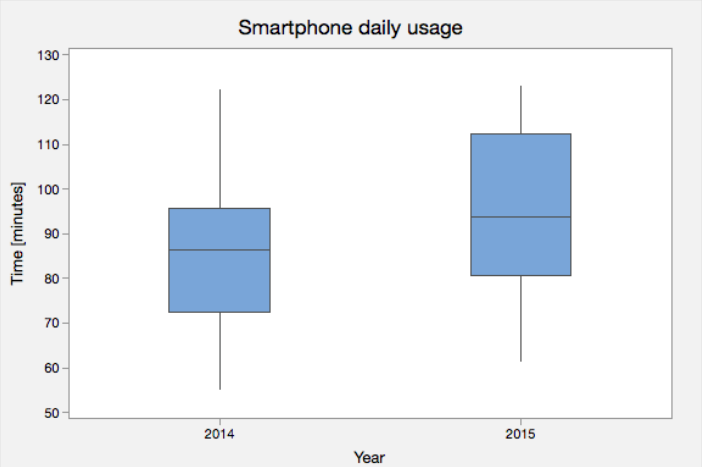


Table 1: Summary statistics for smartphone usage (minutes per day)

2014		*2015*	
Mean	86.129	Mean	94.759
Median	86.5	Median	93.68
Standard Deviation	17.586	Standard Deviation	17.469
Sample Variance	309.245	Sample Variance	305.138
Range	66.93	Range	61.58
Minimum	55.13	Minimum	61.41
Maximum	122.06	Maximum	122.99
Sum	2325.47	Sum	2748.02
Count	27	Count	29
Pooled standard deviation		17.525	

Question 1 (8 marks)

A report from MQ Marketing Services on mobile technologies claims that in 2012 Macquarie University students used their smartphones for 78 minutes per day on average. Use an appropriate hypothesis test to address the following research question.

> **Research Question:** Was the average smartphone usage for a student enrolled at Macquarie University in 2014 equal to 78 minutes per day?

Question 2 (9 marks)

Use an appropriate hypothesis test to address the following research question

Research Question: For students enrolled at Macquarie University, was the average smartphone usage the same in 2014 and 2015?

Questions 3 and 4 are based on the study described below:

In order to investigate community awareness of and attitudes to renewable energy in 2014, the New South Wales Government's Office of Environment and Heritage surveyed a large group of adult residents of New South Wales. Some of the variables recorded in this study are described below:

Variable Name	**Variable Description**
Gender	**Gender:** **0 = Male, 1 = Female**
Age	**Age group:** **1 = 18 to 24 years, 2 = 25 to 34 years,** **3 = 35 to 49 years, 4 = 50 to 64 years,** **5 = 65 years and over**
Education	**Highest educational level:** **1 = university degree,** **2 = TAFE/apprenticeship,** **3 = school only**
Expansion	**Over the next five years, the amount of electricity produced from renewables in New South Wales should:** **1 = increase** **2 = stay the same as now** **3 = decrease**
PersonalCost	**Using renewable energy to produce electricity in NSW is:** **1 = a good idea and I am prepared to pay more for electricity to support it** **2 = a good idea if I don't have to pay more for electricity** **3 = not a good idea**

Consider the table below which was constructed using some of the data recorded in this study.

	Gender		Age					Education		
	Males	Females	18-24 years	25-34 years	35-49 years	50-64 years	65+ years	university	TAFE/ apprenticeship	school only
Expansion (in production of renewable energy over the next 5 years)										
Produce more from renewables	828	842	149	192	495	408	392	612	625	454
Stay the same as now	130	90	10	13	46	59	121	34	90	79
Produce less from renewables	30	20	7	2	12	20	17	14	23	17
PersonalCost (attitude to renewable energy in terms of personal cost)										
Good idea and prepared to pay more	329	301	68	63	201	147	138	333	211	136
Good idea if I don't have to pay more	629	651	95	143	357	319	370	326	497	408
Not a good idea	30	20	3	2	6	20	33	14	23	17

Question 3 (9 marks)

Use any relevant information from the table above to carry out an appropriate hypothesis test to answer the following research question.

Research Question: *Among 18 to 24 year olds in New South Wales, do 80% believe that NSW should produce more electricity from renewables over the next 5 years, with the remaining 20% evenly divided between those who think the amount produced should stay the same and those who think the amount produced should decrease?*

Hypothesis Test:

Question 4 (14 marks)

a. ***Research Question:*** *Amongst residents of New South Wales, do attitudes to renewable energy, in terms of personal cost, vary by age group?*

Use the following information, which was constructed from the results of the survey, to carry out an appropriate hypothesis test to address this question.

Each cell in the table below contains three values:

- the observed count (at the top of the cell)
- the expected count (in brackets in the middle of the cell)
- the contribution to the chi-squared statistic i.e. the standardised discrepancy (at the bottom of the cell)

Age group vs Attitude to renewable energy in terms of personal cost

	18-24	25-34	35-49	50-64	65+	All
Good idea and prepared to pay more	68	63	201	147	138	617
	(52.12)	(65.31)	(177.09)	(152.60)	(169.87)	
	4.8361	0.0818	3.2273	0.2056	5.9797	
Good idea if I don't have to pay more	95	143	357	319	370	1284
	(108.47)	(135.91)	(368.54)	(317.57)	(353.51)	
	1.6728	0.3694	0.3612	0.0064	0.7694	
Not a good idea	3	2	6	20	33	64
	(5.41)	(6.77)	(18.37)	(15.83)	(17.62)	
	1.0712	3.3650	8.3292	1.0991	13.4239	
All	166	208	564	486	541	1965

Chi-Square Statistic = *****, DF = ****, P-Value = 0.000

Hypothesis Test:

b. ***Research Question:*** *Amongst residents of New South Wales, which factor/s best determine community attitudes to renewable energy in terms of personal cost?*

` Now consider the output below, together with your conclusion to part a. In the space below this output, write a paragraph summarising your response to the research question above. Do not write up any hypothesis tests for this part of the question. Use the results of relevant hypothesis tests to write a clear conclusion, stating which factors (age, gender, education) are more useful and which are less useful for determining community attitudes to renewable energy in terms of personal cost.

Gender vs Attitude to renewable energy in terms of personal cost

	Males	Females	All
Good idea and prepared to pay more	329	301	630
	(317.6)	(312.4)	
	0.4113	0.4181	
Good idea if I don't have to pay more	629	651	1280
	(645.2)	(634.8)	
	0.4080	0.4147	
Not a good idea	30	20	50
	(25.2)	(24.8)	
	0.9126	0.9276	
All	988	972	1960

Chi-Square statistic = 3.492, DF = 2, P-Value = 0.174

Education vs Attitude to renewable energy in terms of personal cost

	University	TAFE/ apprenticeship	School only	All
Good idea and prepared to pay more	333	211	136	680
	(232.9)	(253.0)	(194.1)	
	43.027	6.962	17.410	
Good idea if I don't Have to pay more	326	497	408	1231
	(421.6)	(457.9)	(351.4)	
	21.682	3.331	9.101	
Not a good idea	14	23	17	54
	(18.5)	(20.1)	(15.4)	
	1.092	0.422	0.163	
All	673	731	561	1965

Chi-Square statistic = 103.190, DF = 4, P-Value = 0.000

Questions 5 to 7 are based on the study described below:

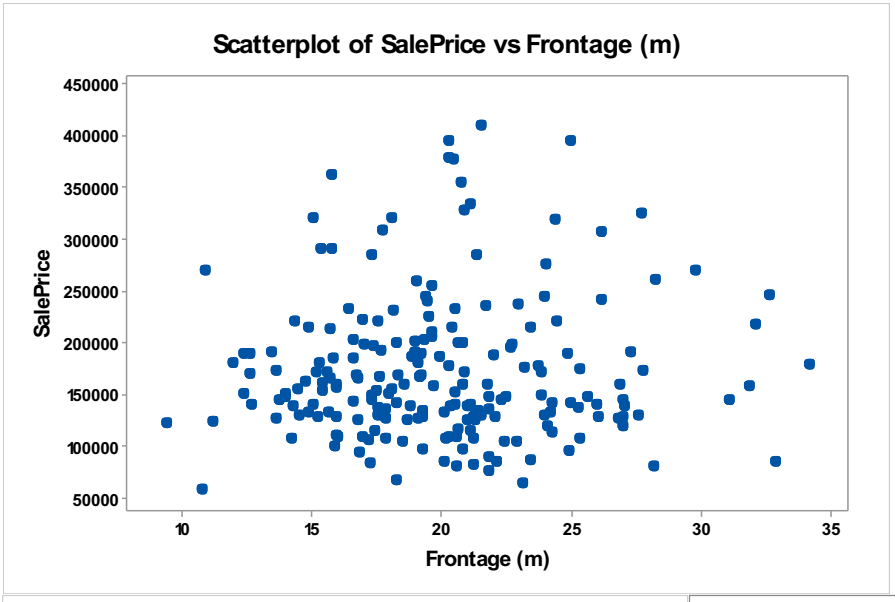
A realtor in Ames, Iowa was interested in the relationship between the sale price of single family homes and various possible predictors. The information on a sample of 206 homes sold in 2010 was obtained from the Ames Assessors' Office. Some of the variables recorded in this study are described below:

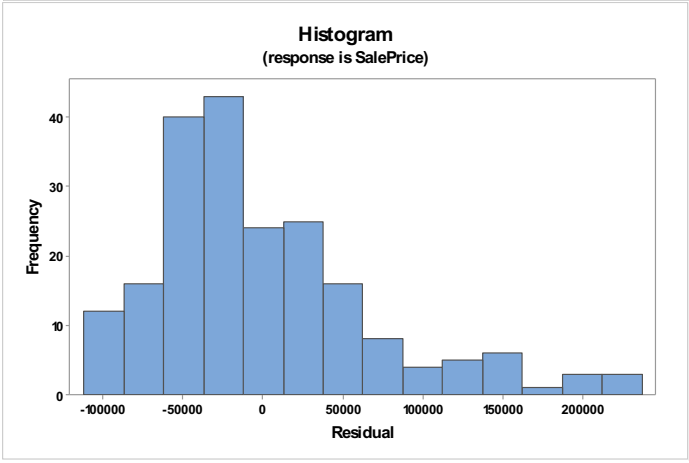
Variable Name	Variable Description
Frontage	**Distance (in metres) from front of house to street**
House Age	**Age of house (in years)**
Years reno	**Number of years since last renovation**
Valuation pre	**Property valuation prior to renovation**
Valuation post	**Property valuation following renovation**
Living area	**Living area (in metres squared)**
Total rooms	**Total number of rooms in the house**
Sale Price	**Sale price in 2010 ($)**
Log Sale Price	**Natural logarithm of sale price ($)**

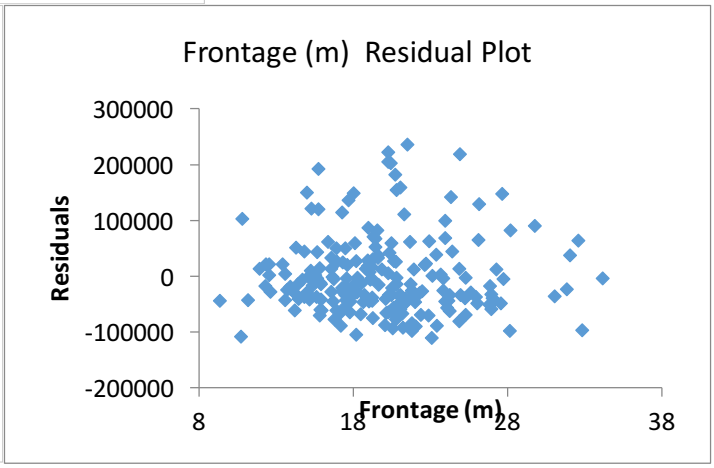
Question 5 (16 marks)

a. The realtor was interested in the relationship between Sale Price ($) and frontage, Sale Price ($) and Living area (square metres) and Sale Price ($) and House age (years). For each pair of variables of interest, use the plots below to describe the relationship between the variables and comment on whether each of the regression assumptions would or would not have been met. If an assumption has not been met describe why it has not been met.

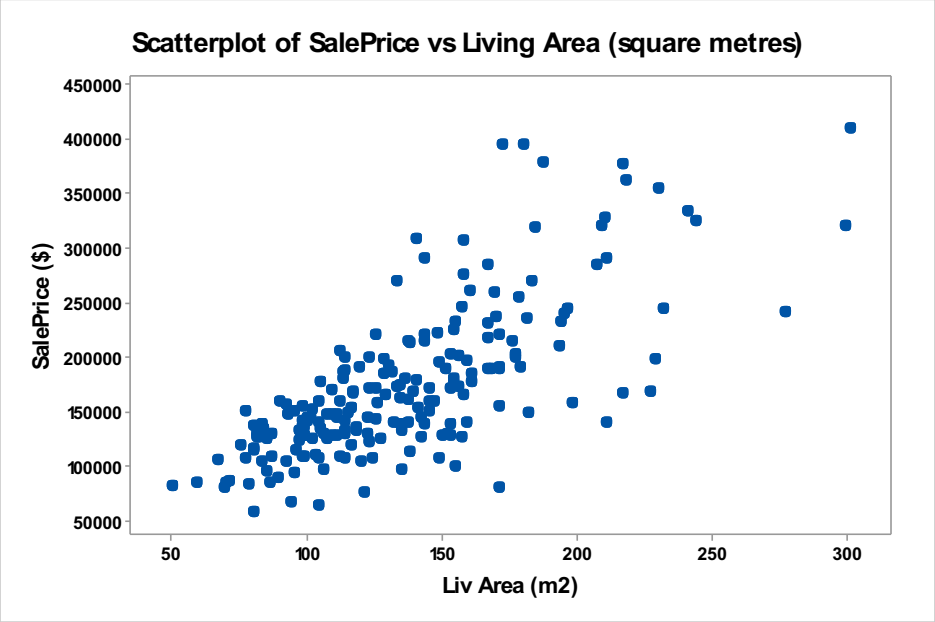
i. Sale Price versus frontage

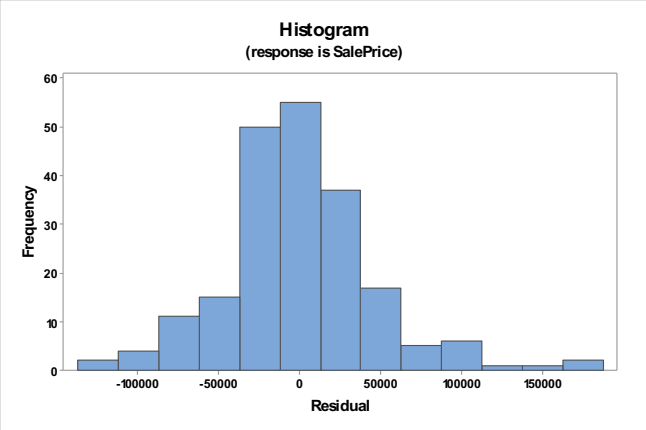


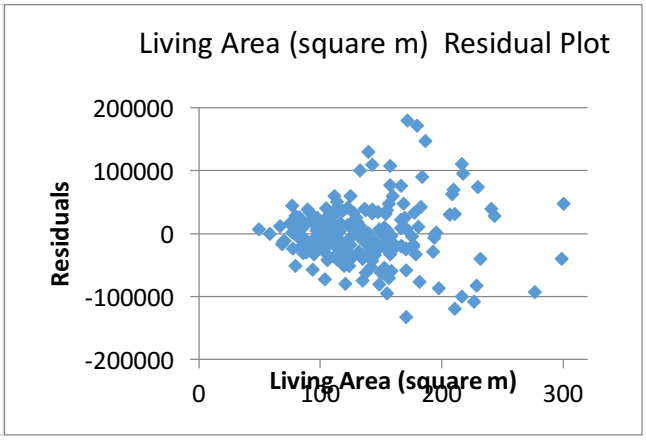




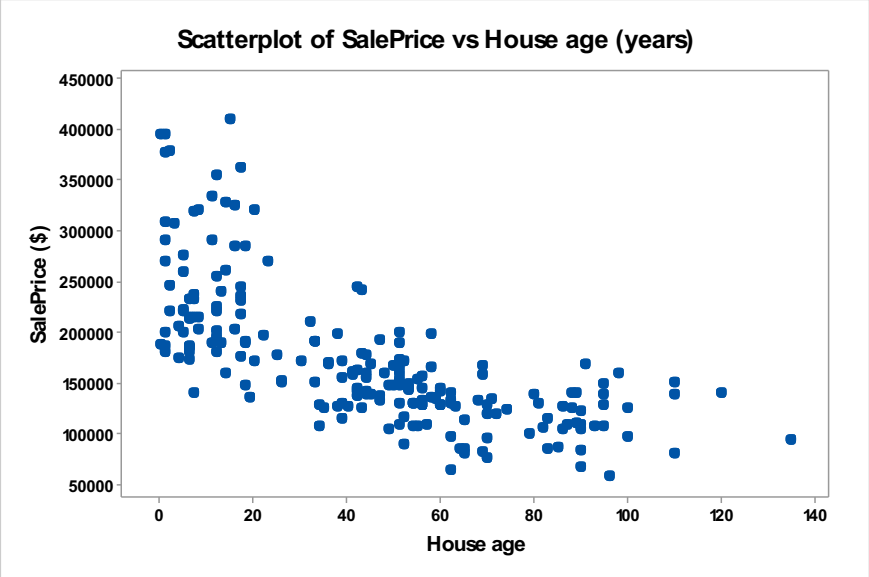
ii. Sale Price versus Living area (square metres)

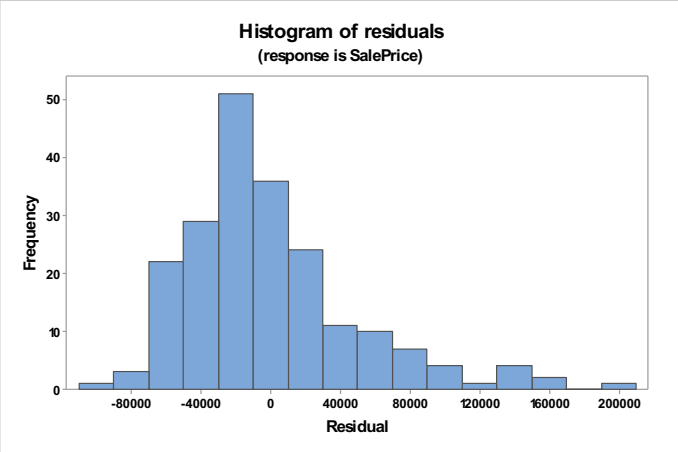


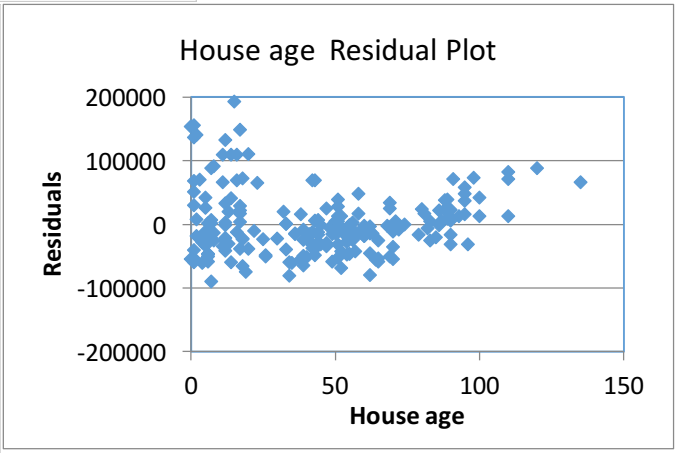




iii. Sale price versus House age (years)







b. The natural logarithm is a commonly used transformation that can correct violations of the regression assumptions. Using Log Sale Price rather than Sale Price none of the regression assumptions are violated for the regressions shown below. Use the relevant output from the regressions shown below to answer the following questions.

Log Sale Price versus Frontage (m) (R^2 = 0.0005)

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	11.9495	0.1174	101.7995	0.0000
Frontage (m)	0.0019	0.0057	0.3327	0.7397

Log Sale Price versus Living area (square metres) (R^2 = 0.5201)

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	11.1611	0.0584	190.9664	0.0000
Living Area (square m)	0.0061	0.0004	14.8689	0.0000

Log Sale Price versus House age (years) (R^2 = 0.5497)

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	12.3811	0.0305	406.5181	0.0000
House age	-0.0090	0.0006	-15.7820	0.0000

i. Consider the following research question:

Research Question: Is there a significant linear relation between the frontage and the log sale price of a property?

To answer this question calculate and interpret a 95% confidence interval for the populations slope of the line that describes the relationship between Log sale price and frontage. Be sure to answer the research question as part of your interpretation. All of the relevant assumptions have been met, you need not comment on these.

ii. Write down the equation of the regression line for the regression of Log sale price versus house age. Interpret the coefficient for house age.

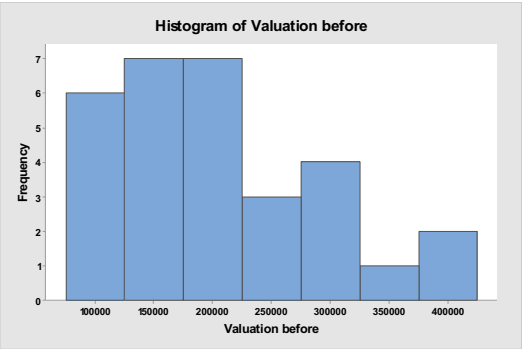
iii. What is the goodness-of-fit statistic for the regression of Log sale price on living area? Interpret the meaning of this value.

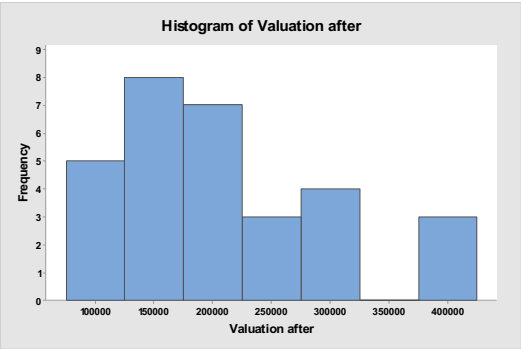
iv. Which of the variables Frontage, Living area and House age is the best predictor of Log Sale Price and why?

Question 6 (7 marks)

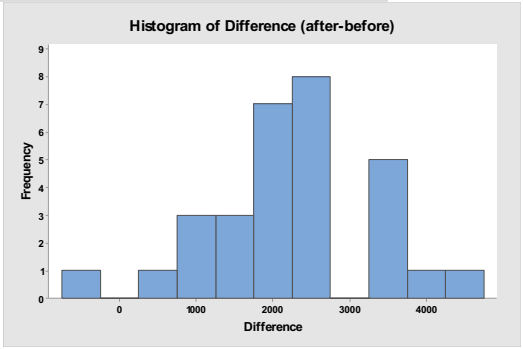
Research Question: Is there a change in the valuation of a property following renovation?

The realtor described earlier was also interested in whether the property value changed substantially before and after renovation. The following output show histograms and summary statistics for the valuation before renovation, the valuation after renovation and the change in valuation (difference) for a sample of 30 properties that were renovated within 5 years of sale (in 2010).





	Valuation after	*Valuation before*	*Difference*
Mean	207661.37	205419.88	2241.49
Standard Error	16008.85	16019.43	195.55
Standard Deviation	87684.07	87742.03	1071.09
Count	30	30	30



Use a suitable hypothesis test to answer the research question.

Question 7 (7 marks)

Research Question: Is the proportion of people renovating their homes equal to 20%?

Information from a magazine on home renovations claims that 20% of house owners in the USA renovated their property in the last 5 years. Of the 206 home owners from Ames, Iowa surveyed in this data set 30 had renovated in the last 5 years. Use a suitable hypothesis test to answer the research question.

Statistical Formulas

$z = \dfrac{y - \mu}{\sigma}$ $\quad z = \dfrac{\bar{y} - \mu}{\sigma/\sqrt{n}}$ (for sample mean) $\quad z = \dfrac{p - \pi}{\sqrt{\pi\,(1-\pi\,)/n}}$ (for sample proportion)

$z = \dfrac{\bar{y} - \mu_0}{\sigma/\sqrt{n}}$ $\qquad$ 95% CI: $\bar{y} \pm 1.96\dfrac{\sigma}{\sqrt{n}}$

$z = \dfrac{p - \pi_0}{\sqrt{\pi_0(1-\pi_0)/n}}$ $\qquad$ 95% CI: $p \pm 1.96\sqrt{\dfrac{p(1-p)}{n}}$

$t = \dfrac{\bar{y} - \mu_0}{s/\sqrt{n}}$, $\quad$ (df: $\nu = n-1$) $\qquad$ 95% CI: $\bar{y} \pm t_\nu \dfrac{s}{\sqrt{n}}$

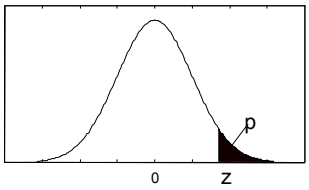
$t = \dfrac{\bar{y}_d - \mu_0}{s_d/\sqrt{n}}$, $\quad (\nu = n_d - 1)$ $\qquad$ 95% CI: $\bar{y}_d \pm t_\nu \dfrac{s_d}{\sqrt{n}}$

$t = \dfrac{\bar{y}_1 - \bar{y}_2}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$, $(\nu = n_1 + n_2 - 2)$ $\qquad$ 95% CI: $(\bar{y}_1 - \bar{y}_2) \pm t_\nu s_p \sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}$

$s_p = \sqrt{\dfrac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1 + n_2 - 2}}$

$t = \dfrac{b}{se(b)}$, $\quad (\nu = n-2)$ $\qquad$ 95% CI: $b \pm t_{n-2}\, se(b)$

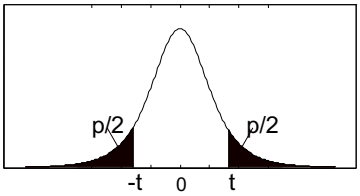
$\chi^2 = \sum_{j=1}^{c} \dfrac{(O_j - E_j)^2}{E_j}$ $\quad (\nu = c-1)$ $\qquad$ $\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c} \dfrac{(O_{ij} - E_{ij})^2}{E_{ij}}$ $\quad (\nu = (r-1)(c-1))$



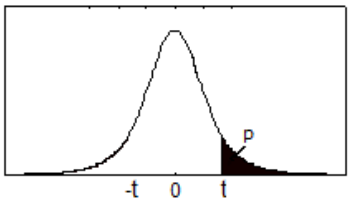
|z|	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
4.0	.000032									

Standard Normal Probabilities: Single tail areas corresponding to z-values for the standardised normal curve

Two-tailed

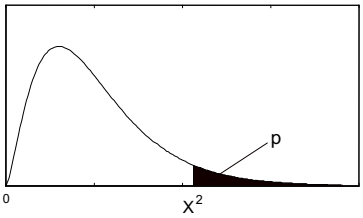


One-tailed



Two-tailed	0.0005	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5
One-tailed	0.00025	0.0005	0.001	0.0025	0.005	0.01	0.025	0.05	0.1	0.25
ν										
1	1273	636.6	318.3	127.3	63.66	31.82	12.71	6.314	3.078	1.000
2	44.70	31.60	22.33	14.09	9.925	6.965	4.303	2.920	1.886	0.816
3	16.33	12.92	10.22	7.453	5.841	4.541	3.182	2.353	1.638	0.765
4	10.31	8.610	7.173	5.598	4.604	3.747	2.776	2.132	1.533	0.741
5	7.976	6.869	5.893	4.773	4.032	3.365	2.571	2.015	1.476	0.727
6	6.788	5.959	5.208	4.317	3.707	3.143	2.447	1.943	1.440	0.718
7	6.082	5.408	4.785	4.029	3.499	2.998	2.365	1.895	1.415	0.711
8	5.617	5.041	4.501	3.833	3.355	2.896	2.306	1.860	1.397	0.706
9	5.291	4.781	4.297	3.690	3.250	2.821	2.262	1.833	1.383	0.703
10	5.049	4.587	4.144	3.581	3.169	2.764	2.228	1.812	1.372	0.700
11	4.863	4.437	4.025	3.497	3.106	2.718	2.201	1.796	1.363	0.697
12	4.716	4.318	3.930	3.428	3.055	2.681	2.179	1.782	1.356	0.696
13	4.597	4.221	3.852	3.372	3.012	2.650	2.160	1.771	1.350	0.694
14	4.499	4.140	3.787	3.326	2.977	2.624	2.145	1.761	1.345	0.692
15	4.417	4.073	3.733	3.286	2.947	2.602	2.131	1.753	1.341	0.691
16	4.346	4.015	3.686	3.252	2.921	2.583	2.120	1.746	1.337	0.690
17	4.286	3.965	3.646	3.222	2.898	2.567	2.110	1.740	1.333	0.689
18	4.233	3.922	3.610	3.197	2.878	2.552	2.101	1.734	1.330	0.688
19	4.187	3.883	3.579	3.174	2.861	2.539	2.093	1.729	1.328	0.688
20	4.146	3.850	3.552	3.153	2.845	2.528	2.086	1.725	1.325	0.687
21	4.110	3.819	3.527	3.135	2.831	2.518	2.080	1.721	1.323	0.686
22	4.077	3.792	3.505	3.119	2.819	2.508	2.074	1.717	1.321	0.686
23	4.047	3.768	3.485	3.104	2.807	2.500	2.069	1.714	1.319	0.685
24	4.021	3.745	3.467	3.091	2.797	2.492	2.064	1.711	1.318	0.685
25	3.996	3.725	3.450	3.078	2.787	2.485	2.060	1.708	1.316	0.684
26	3.974	3.707	3.435	3.067	2.779	2.479	2.056	1.706	1.315	0.684
27	3.954	3.690	3.421	3.057	2.771	2.473	2.052	1.703	1.314	0.684
28	3.935	3.674	3.408	3.047	2.763	2.467	2.048	1.701	1.313	0.683
29	3.918	3.659	3.396	3.038	2.756	2.462	2.045	1.699	1.311	0.683
30	3.902	3.646	3.385	3.030	2.750	2.457	2.042	1.697	1.310	0.683
35	3.836	3.591	3.340	2.996	2.724	2.438	2.030	1.690	1.306	0.682
40	3.788	3.551	3.307	2.971	2.704	2.423	2.021	1.684	1.303	0.681
45	3.752	3.520	3.281	2.952	2.690	2.412	2.014	1.679	1.301	0.680
50	3.723	3.496	3.261	2.937	2.678	2.403	2.009	1.676	1.299	0.679
60	3.681	3.460	3.232	2.915	2.660	2.390	2.000	1.671	1.296	0.679
70	3.651	3.435	3.211	2.899	2.648	2.381	1.994	1.667	1.294	0.678
80	3.629	3.416	3.195	2.887	2.639	2.374	1.990	1.664	1.292	0.678
90	3.612	3.402	3.183	2.879	2.632	2.368	1.987	1.662	1.291	0.677
100	3.598	3.390	3.174	2.871	2.626	2.364	1.984	1.660	1.290	0.676
∞	3.481	3.291	3.090	2.807	2.576	2.326	1.960	1.645	1.282	0.674

t-Distribution: Values of |t| corresponding to two-tailed and one-tailed p-values for Student's t- distribution



ν	.0005	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5
1	12.12	10.83	9.550	7.879	6.635	5.412	3.842	2.706	1.642	0.455
2	15.20	13.82	12.43	10.60	9.210	7.824	5.992	4.605	3.219	1.386
3	17.73	16.27	14.80	12.84	11.34	9.837	7.815	6.251	4.642	2.366
4	20.00	18.47	16.92	14.86	13.28	11.67	9.488	7.779	5.989	3.357
5	22.11	20.52	18.91	16.75	15.09	13.39	11.07	9.236	7.289	4.352
6	24.10	22.46	20.79	18.55	16.81	15.03	12.59	10.64	8.558	5.348
7	26.02	24.32	22.60	20.28	18.48	16.62	14.07	12.02	9.803	6.346
8	27.87	26.12	24.35	21.95	20.09	18.17	15.51	13.36	11.03	7.344
9	29.67	27.88	26.06	23.59	21.67	19.68	16.92	14.68	12.24	8.343
10	31.42	29.59	27.72	25.19	23.21	21.16	18.31	15.99	13.44	9.342
11	33.14	31.26	29.35	26.76	24.72	22.62	19.68	17.28	14.63	10.34
12	34.82	32.91	30.96	28.30	26.22	24.05	21.03	18.55	15.81	11.34
13	36.48	34.53	32.54	29.82	27.69	25.47	22.36	19.81	16.98	12.34
14	38.11	36.12	34.09	31.32	29.14	26.87	23.68	21.06	18.15	13.34
15	39.72	37.70	35.63	32.80	30.58	28.26	25.00	22.31	19.31	14.34
16	41.31	39.25	37.15	34.27	32.00	29.63	26.30	23.54	20.47	15.34
17	42.88	40.79	38.65	35.72	33.41	31.00	27.59	24.77	21.61	16.34
18	44.43	42.31	40.14	37.16	34.81	32.35	28.87	25.99	22.76	17.34
19	45.97	43.82	41.61	38.58	36.19	33.69	30.14	27.20	23.90	18.34
20	47.50	45.31	43.07	40.00	37.57	35.02	31.41	28.41	25.04	19.34
21	49.01	46.80	44.52	41.40	38.93	36.34	32.67	29.62	26.17	20.34
22	50.51	48.27	45.96	42.80	40.29	37.66	33.92	30.81	27.30	21.34
23	52.00	49.73	47.39	44.18	41.64	39.97	35.17	32.01	28.43	22.34
24	53.48	51.18	48.81	45.56	42.98	40.27	36.42	33.20	29.55	23.34
25	54.95	52.62	50.22	46.93	44.31	41.57	37.65	34.38	30.68	24.34
26	56.41	54.05	51.63	48.29	45.64	42.86	38.89	35.56	31.79	25.34
27	57.86	55.48	53.02	49.64	46.96	44.14	40.11	36.74	32.91	26.34
28	59.30	56.89	54.41	50.99	48.28	45.42	41.34	37.92	34.03	27.34
29	60.73	58.30	55.79	52.34	49.59	46.69	42.56	39.09	35.14	28.34
30	62.16	59.70	57.17	53.67	50.89	47.96	43.77	40.26	36.25	29.34
35	69.20	66.62	63.95	60.27	57.34	54.24	49.80	46.06	41.78	34.34
40	76.09	73.40	70.62	66.77	63.69	60.44	55.76	51.81	47.27	39.34
45	82.88	80.08	77.18	73.17	69.96	66.56	61.66	57.51	52.73	44.34
50	89.56	86.66	83.66	79.49	76.15	72.61	67.50	63.17	58.16	49.33
60	102.7	99.61	96.40	91.95	88.38	84.58	79.08	74.40	68.97	59.33
70	115.6	112.3	108.9	104.2	100.4	96.39	90.53	85.53	79.71	69.33
80	128.3	124.8	121.3	116.3	112.3	108.1	101.8	96.58	90.41	79.33
90	140.8	137.2	133.5	128.3	124.1	119.6	113.1	107.6	101.0	89.33
100	153.2	149.4	145.6	140.2	135.8	131.1	124.3	118.5	111.7	99.33

χ^2 – Distribution: Values of χ^2 corresponding to p-values for the chi-squared distribution