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Statistical Methods and Computing – Final Project

The group compared proportions of music played on radio stations WMT 96.5FM and KBEA 99.7FM.

$$H_o: p_1 = p_2$$

$$H_a: p_1 \neq p_2$$

Where p_1 refers to the proportion of music played per hour on station WMT 96.5FM and p_2 refers to the proportion played on KBEA 99.7FM

The group also tested whether instantaneous random sampling gives similar proportions to those found with continuous sampling.

$$H_0: p_c = p_i$$

$$Ha: p_c \neq p_i$$

Where p_c refers to the proportion of music played per hour found with continuous sampling. The proportion of music played per hour found with the instantaneous sampling is represented by p_i.

All samples were taking between 12:00 pm and 6:00 pm to attempt to avoid variation in what might be played at different times.

Part 1 – Instantaneous Random Sampling of 99.7FM and 96.5FM:

Instantaneous random sampling data was taken of KBEA 99.7FM and WMT 96.5FM. The random sample times were found using www.random.org. For collection of this data, the radio was turned on at the times generated and the instantaneous state of the radio was recorded. This was done for both stations at the same time for accurate comparison. This data was then organized into proportions and interpreted using SAS chi-square tests. Raw instantaneous sampling data can been seen in Appendix A.

The FREQ Procedure

Table of station by type

station Frequency Percent Row Pct Col Pct	C	M	T	Total
96.5	12 12.00 24.00 54.55	32 32.00 64.00 47.76	6 6.00 12.00 54.55	50 50.00
99.7	10 10.00 20.00 45.45	35 35.00 70.00 52.24	5 5.00 10.00 45.45	50 50.00
Total	22 22.00	67 67.00	11 11.00	100 100.00

Statistics for Table of station by type

Statistic	DF	Value	Prob
Chi-Square	2	0.4071	0.8158
Likelihood Ratio Chi-Square	2	0.4075	0.8157
Mantel-Haenszel Chi-Square	1	0.0311	0.8599
Phi Coefficient		0.0638	
Contingency Coefficient		0.0637	
Cramer's V		0.0638	

Sample Size = 100

The chi-square test of the instantaneous sampling shows that the two stations are not statistically different in how much music is played per hour. The null hypothesis cannot be rejected. This is confirmed by the high p-value which is approximately 0.82.

Part 2 – Comparisons of Continuous Sampling and Instantaneous Sampling of 99.7FM:

A continuous sampling of KBEA 99.7FM and compared to the instantaneous sampling from the same station. The continuous sample data can be seen in Appendix B. The proportions of music played each hour were used in the SAS calculations. "Proc means" was used to interpret this data. This gave the group a 95% confidence interval for the proportion of music played per hour that was then used to compare with the random sampling. These proportions were as follows:

Hour 1: 81.67%
Hour 2: 81.67%
Hour 3: 81.67%
Hour 4: 76.67%
Hour 5: 80.00%
Hour 6: 78.33%

The MEANS Procedure

Analysis Variable : proportion

N	Mean	Std Dev	Std Error	Lower 95% CL for Mean	Upper 95% CL for Mean
6	0.8000167	0.0210924	0.0086109	0.7778815	0.8221518

This test gave us a 95% confidence interval of 78% to 82% music played per hour on 99.7FM. The mean is approximately 80% with a standard deviation of 2.11%.

The FREQ Procedure

type	Frequency	Percent	Cumulative Frequency	Cumulative Percent
music	35	70.00	35	70.00
nonmusic	15	30.00	50	100.00

Binomial Proportion
for type = music

Proportion	0.7000
ASE	0.0648
95% Lower Conf Limit	0.5730
95% Upper Conf Limit	0.8270
Exact Conf Limits	
95% Lower Conf Limit	0.5539
95% Upper Conf Limit	0.8214

Test of H0: Proportion = 0.5

ASE under H0	0.0707
Z	2.8284
One-sided Pr > Z	0.0023
Two-sided Pr > |Z|	0.0047

Sample Size = 50

For this "proc freq" analysis, the proportions of music versus non-music of the instantaneous sampling were compared. This test shows that instantaneous random sampling does not give a completely accurate depiction of what is actually being played. The continuous sampling test gave us a confidence interval of 78% to 82% music played. The instantaneous sampling data provided a 95% exact confidence interval of 55% to 82%. These two intervals have the same upper limit, but very different lower limits. The proportion of music played on 99.7FM in the instantaneous sampling test was only 70%, which is outside the 95% confidence interval provided by the continuous sampling interval. Therefore the difference is statistically significant and the null hypothesis should be rejected.