Statistics and Probability Assignment with solution

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Questions

Q1) The maximum weight that an elevator in an apartment complex can accommodate is 800kg. The average adult weight be about 70 kgs with a variance of 200. What is the probability that the lift safely reaches the ground when there are 10 adults in the lift?

Given mean= 70
variance = 200
hence mean for 10 adults = 10 * 70= 700
variance for 10 adults = 10 * 200= 2000
therefore standard deviation (Sd) = sqrt (2000) = 44.72
If the weight > 800 kg causes the elevator to "unsafely" reach the ground, then we can find the upper tail of our normal distribution:
P (Weight of 10 adults > 800 kg).

$$Z - score = \frac{(X-mu)}{SD} = \frac{(800-700)}{44.72} = 2.24$$

Hence P (Z<2.24), using z table we get 0.9875 or 98.75%
Hence it is safe to reach the ground when there are 10 adults in the lift.

Q2) The life of a 60- watt light bulb in hours is known to be normally distributed with σ = 25 hours. Create 5 different random samples of 100 bulbs each which has a mean life of x_bar ~ 1000 hours and perform one-way ANOVA with state it.

sample 1	sample 2	sample 3	sample 4	sample 5
985.0781	964.6136	976.9706	971.0627449	998.9048
1045.959	955.188	980.5609	1029.350349	994.1333
1016.02	996.1133	1003.516	1009.36822	1022.389
999.9653	1034.135	1032.293	968.0032255	993.6812
1028.147	1044.763	961.8915	1006.914264	1026.612
1009.278	1007.006	1016.183	962.6759798	970.256
984.9619	974.8935	968.1783	960.0129759	983.716
956.7309	993.1224	979.7955	1001.891368	1015.843
977.7208	1027.261	1003.699	982.8716316	1006.295
1015.916	1004.377	1037.804	1020.52129	978.1191
1042.769	1011.116	1011.044	986.4152116	1012.508
973.5986	975.6559	976.6027	1004.090936	1020.169
984.2687	1001.774	994.089	990.5674101	1000.102
1012.136	1028.029	996.357	1008.190768	989.0929
998.6339	993.5582	953.9409	1002.270078	995.9735
992.7198	991.552	997.5449	1009.484387	974.8928
975.0244	958.6726	1018.621	1036.050587	956.0037
987.3262	992.8671	981.5711	990.0918993	1053.611
1024.434	1010.263	987.6308	973.4798585	1008.065
1005.247	1023.115	1045.366	1041.917736	1049.426
945.4442	1012.93	1018.417	1039.04554	981.8026
1055.997	1020.399	977.6914	998.2627319	1009.764
1001.472	972.6089	981.6839	1026.568905	995.4342
971.4838	994.7906	970.9024	1006.089372	1017.228
999.5012	993.3939	981.8892	1013.760347	974.6902

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
sample 1	101	100867	998.6827	589.4664
sample 2	101	101227	1002.247	645.4165
sample 3	101	100557.3	995.6169	681.0503
sample 4	101	101108.6	1001.075	529.7452
sample 5	101	100785	997.8711	666.1316

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	5217.382	4	1304.345	2.095799	0.080202	2.389767
Within Groups	311181	500	622.362			
Total	316398.4	504				

One way ANOVA tests the null hypothesis that the sample are drawn from populations with equal means.
The Hypthesis is rejected if the P-value from the test is less than the required alpha level (0.05) or if the F statistic is greather than the critical value.
One way ANOVA for the 5 Samples result in
The function =*NORMINV(RAND( ), mean ,standard deviation)*
P- VALUES - 0.080202
F VALUES - 2.095799
F - CRITICAL VALUES - 2.389767

Complete data in excel
answer: the samples are drawn from populations with different means

Q3) Fifteen trainees in a technical program are randomly assigned to three different types of instructional approaches, all of which are concerned with developing a specified level of skill in computer-assisted design. The achievement test scores at the conclusion of the instructional unit are reported in Table along with the mean performance score associated with each instructional approach. Use the analysis of variance procedure to test the null hypothesis that the three-sample means were obtained from the same population, using the 5 percent level of significance for the test.

Instrumental Method	Test Scores					Total Scores	Mean Test Scores
A1	86	79	81	70	84	400	80
A2	90	76	88	82	89	425	85
A3	82	68	73	71	81	375	75

Ans

	A1	A2	A3
	86	90	82
	79	76	68
	81	88	73
	70	82	71
	84	89	81
total	400	425	375
mean	80	85	75

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
A1	5	400	80	38.5
A2	5	425	85	35
A3	5	375	75	38.5

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	250	2	125	3.34821	0.06991	3.88529
Within Groups	448	12	37.33333333			
Total	698	14				

Step 1: Under the Data tab, click on "Data Analysis."
step2 : In the "Data Analysis" window, select the first option, "Anova: Single Factor."
Step 3: In the next window for "Input Range," select range.
step 4:Since we have selected the data with headers, check the box "Labels in First Row."
Step 5: Now select the output range as one of the cells in the same worksheet.
Step 6: Click on Ok to complete the calculation. Now we will have detailed Anova: Single Factor analysis.

First, look at the "P-Value," i.e., **0.069909,** which is greater than alpha or significance value (0.05), so we cannot reject the null hypothesis.
Next, **F value 3.348** is less than the **FCrit value 3.885**, so we cannot reject the null hypothesis.
So, we can conclude the test as "Scores of A1, A2, and A3 are not significantly different."

Things to Remember

You need strong ANOVA knowledge to understand things better.
Always frame the Null Hypothesis and the Alternative Hypothesis.
If the F value is > FCrit value," then we can reject the null hypothesis.
"If F value is < FCrit value," then we cannot reject the null hypothesis.
We have the sample of the scores of 15 students (First Group, Second Group, Third Group). Each group consists of 5 students. We calculate the mean of each group. We should find out whether these means are different significantly (whether they were chosen from the different populations),
α=0.05.
$H0$:$\mu1=\mu2=\mu3$
$H1$: at least one of the means is different.
Using Single-Factor ANOVA in Excel we get pp-value\approx 0.0699>α. So we accept $H0$(null hypothesis).
Three different types of the instructional approaches have the same effect on the students.