Introduction to Statistics in Psychology: PSY 201

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FINAL EXAM

Name _____

Total points on the exam is 100. The exam will count as 15% of your class grade. Write your answers on the exam. Including all of your intermediate work will give you the best chance of getting partial credit (if necessary). The problem with your lowest score will be dropped from your grade.

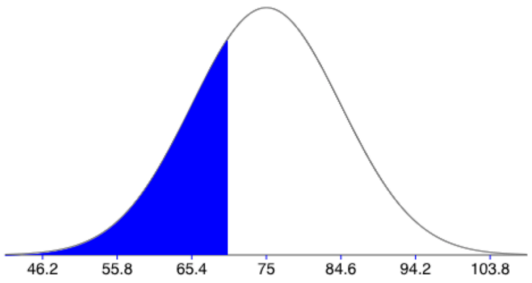
(1) Suppose you have 60 scores from a test that are normally distributed. It has a mean of 75 and a standard deviation of 9.6. Use the appropriate calculator output from the screen shots on the following two pages to answer the questions below.

a) How many scores are below 50 and above 70?

b) What is the 70th percentile?

c) What is percentile rank 70?

Normal Distribution Calculator



Specify Parameters:

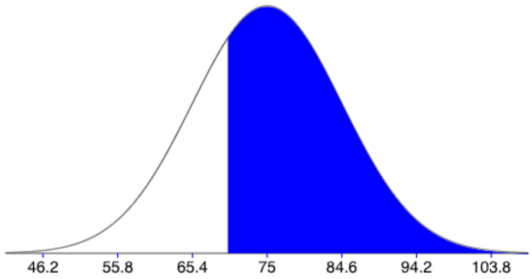
Mean 75 SD 9.6

- ○ Above 1.96
- ◉ Below 70
- ○ Between -1.96 and 1.96
- ○ Outside -1.96 and 1.96

Shaded area: 0.3012

Recalculate

Normal Distribution Calculator



Specify Parameters:

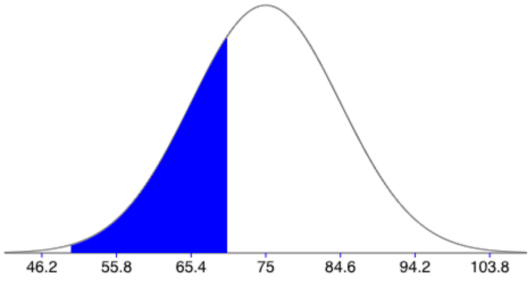
Mean 75 SD 9.6

- ◉ Above 70
- ○ Below 70
- ○ Between -1.96 and 1.96
- ○ Outside -1.96 and 1.96

Shaded area: 0.6988

Recalculate

Normal Distribution Calculator



Specify Parameters:

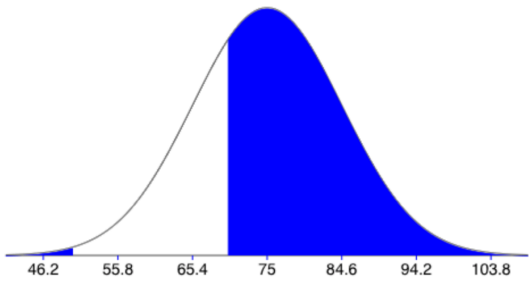
Mean 75 SD 9.6

- ○ Above 70
- ○ Below 70
- ◉ Between 50 and 70
- ○ Outside 30 and 70

Shaded area: 0.2966

Recalculate

ormal Distribution Calculator



Specify Parameters:

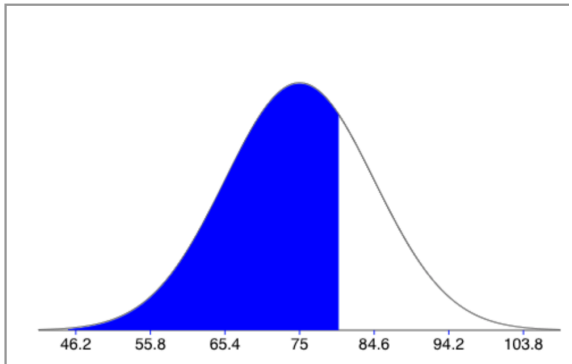
Mean 75 SD 9.6

- ○ Above 70
- ○ Below 70
- ○ Between 50 and 70
- ◉ Outside 50 and 70

Shaded area: 0.7034

Recalculate

Inverse Normal Distribution Calculator



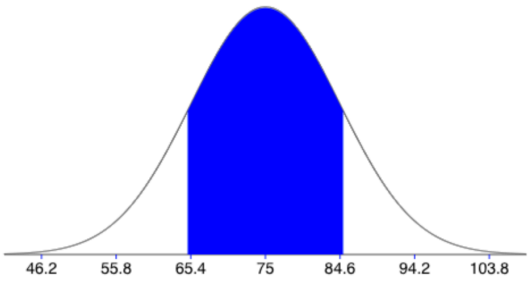
Specify Parameters:

Mean 75
SD 9.6
Area .7

- Above
- Below 80.03
- Between
- Outside

Recalculate

Inverse Normal Distribution Calculator



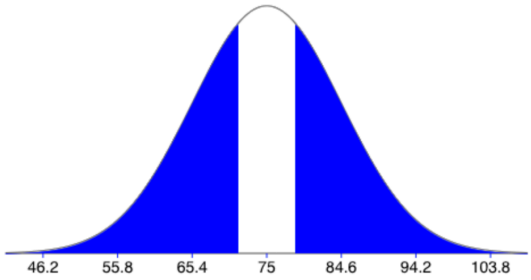
Specify Parameters:

Mean 75
SD 9.6
Area .7

- Above
- Below
- Between 65.05 and 84.95
- Outside

Recalculate

Inverse Normal Distribution Calculator



Specify Parameters:

Mean 75
SD 9.6
Area .7

- Above
- Below
- Between
- Outside 71.305 and 78.695

Recalculate

(2) Use the table to answer the following questions.

Class Interval	f	cf
40-49	1	16
30-39	4	15
20-29	6	11
10-19	3	5
0-9	2	2

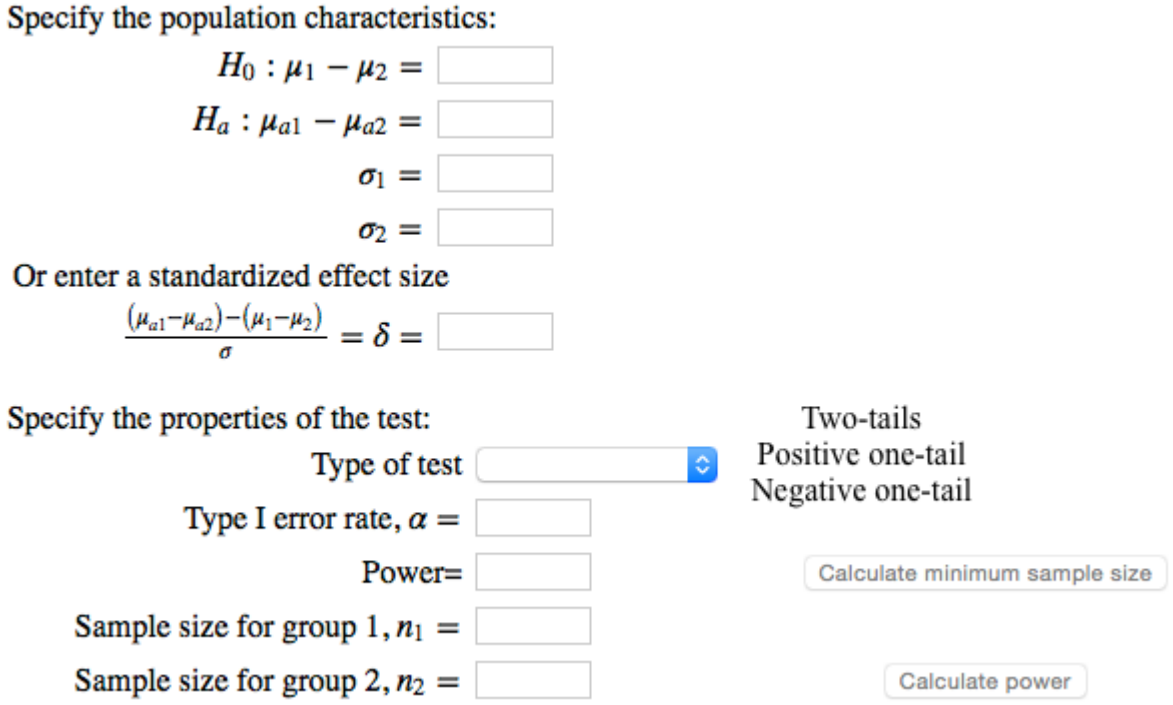
a) Sketch a histogram that represents the data in the table.

b) Sketch a frequency polygon that represents the data in the table.

c) Sketch a cumulative frequency distribution that represents the data in the table.

d) Name one advantage and one disadvantage of using a graph to represent the data relative to presenting the data in a table.

(3) A pediatrician is trying to determine whether honey can be used as an effective treatment of nighttime cough for 7-12 year olds. He will measure treatment effectiveness in terms of how many hours of sleep a child gets during a night (estimated by parents). Based on past studies, he expects the measurement to have a standard deviation of $\sigma = 0.9$ hours. In the study, he will gather data from two independent groups of children with coughs. One set will receive a teaspoon of water, while the other set will receive a teaspoon of honey before they go to bed. The pediatrician estimates that a difference in sleep of 0.75 hours will be of practical importance. He will run a two-sample, non-directional hypothesis test with independent samples and $\alpha = 0.05$. Fill-in the screen shot below of the power calculator so that it will compute the minimal sample size that will produce an experiment with 90% power.



(4) A poll of 119 on-line retailers by `Shop.org` reported that 43% of them intend to offer special discounts or promotions on the first Monday after Thanksgiving.

Build a CI_{90} of the proportion of retailers having discounts or promotions. [Hint: $z_{cv} = \pm 1.645$.]

In the same press release, it was reported that 37% of on-line shoppers intend to use their computers at work for holiday shopping. This was based on a sample of 1891 shoppers. Build a CI_{95} of the number of on-line shoppers intending to use their work computer for holiday shopping. [Hint: $z_{cv} = \pm 1.96$.]

(5) A researcher explored how the phrasing of questions can influence eye-witness testimony. Twenty subjects watched a film of a car accident where one car hit another while traveling at 20 mph. Subjects were asked to judge the speed of the first car at the time of impact. Subjects were separated into groups of five and asked one of the following questions:

Question
How fast was the car going at the time of the accident?
How fast was the car going when it hit the other car?
How fast was the car going when it crashed into the other car?
How fast was the car going when it smashed into the other car?

The psychologist ran an ANOVA to compare the means. Complete the ANOVA summary table below by filling in the values for each cell marked by *:

Source	df	SS	MS	F	p-value
Between	*	253.9014	*	*	0.02021
Within	*	311.4603	*		
Total	19	565.3617			

Condition	Mean	Standard deviation	Sample size
Time	26.515257208	3.146625697536361	5
Hit	25.67508023	4.750034790277722	5
Crashed	29.238606054	4.922478729363647	5
Smashed	34.788447244	4.601109002921666	5

Does the type of question seem to influence the estimated speed of the car? On what do you base your conclusion?

Suppose you wanted to set up a contrast to test whether the sentences with the active nouns *Crashed* and *Smashed* have bigger speed estimates than the sentences with more passive nouns/verbs *Time* and *Hit*. Write out an appropriate null hypothesis by identifying contrast weights for each population mean.

(6) Explain why the power of an experiment analyzed with ANOVA decreases as you add contrast tests.

(7) At the start of the college football season, the Big Ten Network provides a "power ranking" of each football team in the conference. The table below lists the 2018 pre-season and final (just before the championship game) rankings.

Team	Pre-season	Final
Illinois	14	13
Indiana	12	11
Iowa	6	5
Maryland	10	12
Michigan	3	2
Michigan State	4	8
Minnesota	11	10
Northwestern	7	4
Nebraska	8	7
Ohio State	1	1
Penn State	5	3
Purdue	9	9
Rutgers	13	14
Wisconsin	2	6

The data were entered in to the One-sample correlation test calculator, with the (partial) output below. Fill in the **four** blanks.

Fisher z Test summary	
Null hypothesis	$H_0 : \rho = 0$
Alternative hypothesis	$H_a : \rho \neq 0$
Type I error rate	$\alpha = 0.05$
Sample size	$n =$
Sample correlation	$r = 0.8769$
Fisher z transform of ρ	$z_\rho = 0.0000$
Fisher z transform of r	$z_r = 1.3623$
Sample standard error	$s_{z_r} =$
Test statistic	$z =$
p value	$p = 0.000006$
Decision	

Is there a significant correlation between the pre-season and final power rankings?

(8) An instructor wonders if there is a difference in memory for students who complete assignments early versus those who do them later. He uses the data from the *Memory Span* experiment in STATLAB to look for such differences. The first 12 students who completed the lab had an average memory span for digits of $\overline{X}_1 = 6.17$ with $s_1 = 1.34$, while the next 11 students who completed the lab had $\overline{X}_2 = 6.36$ with $s_2 = 1.29$. Using $\alpha = 0.05$, test the null hypothesis:

$$H_0 : \mu_1 - \mu_2 = 0$$

against

$$H_a : \mu_1 - \mu_2 \neq= 0$$

Is the observed difference in mean memory span significant? [Hint: You can answer this question with just a rough estimate of the p-value.]

Compute a 95% confidence interval for the difference of means. [Hint: Use $t_{cv} = 2.079972$.]

(9) In a lexical decision experiment, 100 subjects looked at a set of letters and determined, as quickly as possible, whether they formed a word or not. The time to make the decision was measured for three different conditions. In one condition, *Nonword*, the letters did not form a word (e.g., KERLN). In one condition, *Associated*, the letters formed a word and the word was related to the word of the previous trial (e.g., DOCTOR then NURSE). In a final condition, *Unassociated*, the letters formed a word but the word was not related to the word of the previous trial (e.g., DOCTOR then STAPLER).

The incomplete ANOVA summary table below summarizes a test for differences across the three conditions. Fill in the cells marked by *.

Source	df	SS	MS	F	p-value
Individuals	99	14222555.0485	143662.1722		
Occasions	2	830853.8717	*	*	0.00000
Residual	*	*	*		
Total	299	16624684.9756			

Summary table

Condition	Mean	Standard deviation	Sample size
Associated	717.8563	225.0623	100
Unassociated	711.7713	216.6957	100
Nonwords	826.3262	248.8445	100

Correlation table

	Associated	Unassociated	Nonwords
Associated	1.0000	0.9048	0.8238
Unassociated	0.9048	1.0000	0.8430
Nonwords	0.8238	0.8430	1.0000

Suppose you want to run a contrast to compare the Associated and Unassociated conditions. Describe two problems in the set up below:

Specify hypotheses:

H_0: 3 $\mu_{Associated}$ + -1 $\mu_{Unassociated}$ + -1 $\mu_{Nonwords}$ = 0

H_a: Two-tails

α 0.05

(10) Explain how hypothesis testing controls the Type I error rate, α.

(11) One potential concern with the structure of the class is that students get a false sense of accomplishment with the homework. Since they can guess until they get the right answer, students may not think through their answer before submitting it. As a result, they do not learn how to recognize that they do not understand something, which makes them not fully prepared for the exam. Do you think this is a problem? Explain why or why not.

I am thinking of adding an on-line "Quiz" to the end of each textbook chapter. The quiz will be similar to the homework problems, but will only allow the student to enter one answer for each question. The question will be graded as correct or incorrect, with no opportunity for the student to change the answer. Do you think such a quiz would be helpful? Explain why or why not.