Your name: _____

9.63 –Laboratory in Visual Cognition
Mid-term exam

SHORT QUESTIONS 1 – 9 – ANSWER ALL THE QUESTIONS FOR A TOTAL OF 35 POINTS (estimated time: 20 minutes)

QUESTION 1 (2 pts): When do we use a bar graph instead of a line graph?
To show relationships between Categorical (qualitative) variables

QUESTION 2 (2 pts): Imagine you need to compare two histograms of reaction time that do not have a normal distribution. Which operation could you apply on the reaction time data so that the distributions look more normal?

A log

QUESTION 3 (4 pts): What is an advantage of a 3 factor experimental design over a 2 factor design? What is a disadvantage?

Advantage: Broader picture of how variables interact and under what conditions. You get a better idea of generality
Disadvantage: 3 way interactions are hard to interpret. Experimental design also is more complicated.

QUESTION 4 (4 pts): Why should grades be calculated in terms of Z-score?
Grades in courses should be calculated in terms of z-scores if the mean and standard deviations of the score vary widely from one test to the next. Thus a person eventual rank in the class is calculated more faithfully by finding the mean of the z-scores than by finding the mean of the raw scores of the tests

QUESTION 5 (4 pts): What does an F-test < 1 mean?
Within-groups variance >> Between-group variance

QUESTION 6 (4 pts): Cite two implicit memory tests.

Word-fragment completion task, word stem completion test or Word identification test: subjects saw perceptually degraded word (pieces of each letter were obliterated) and were instructed to name the word (measure of priming)

QUESTION 7 (5 pts): The data of an old-new visual memory experiment are as follows (in term of d prime): 0.2, 0.1, -0.1, -0.3, 0.15, 0.04, -0.03. What can you conclude?

Data at random – one can conclude nothing

QUESTION 8 (5 pts): When testing a brain-damaged patient, which are the control group(s) needed?

Two controls group: (1) control normal, (2) another brain damage population of a different brain damage type

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QUESTION 9 (5 pts): You are using a memory paradigm that requires the participant to listen to a list of words and recall them. You want to induce a false memory for the word "car". Construct a list of 10 words that will do that and explain why you constructed it this way.

Any 10 words having to do with car will do.

EXPERIMENTAL QUESTIONS: CHOOSE ONE QUESTION (QUESTION 11 or 12 – FOR A TOTAL OF 10 POINTS) (estimated time: 10 minutes)

QUESTION 11 (10 pts): Give an explanation of the attentional blink effect. If an observer does not show an attentional blink effect in a trial, what might that mean about whether they processed a) T1 and b) T2 ? Justify your answer.

Several possible reason: they did not see T1 so they had all the attention on T2 OR they were able to process both T1 and T2 (video game players for instance)

OR

QUESTION 12 (10 pts): Sketch a graph of each of the 4 following hypothetical results

a.) A main effect of variable 1, with no main effect of variable 2 and no interaction.
b.) A main effect of variable 1 and variable 2 with interaction.
c.) Interaction, but no main effects of either variable.
d.) No interaction and no main effects of either variable.

INTERPRETATION QUESTIONS: ANSWER ALL THE QUESTIONS 13 – 17 (FOR A TOTAL OF 55 POINTS) (estimated time: 1 hour)

QUESTION 13 (15 pts): When observers view a pattern moving in one direction for a few seconds and then look at a stationary pattern, the stationary pattern will appear to move in the opposite direction (the motion aftereffect). For example, if you stare at something moving to the right for a few seconds, then a stationary pattern will appear to move to the left.

You are conducting an experiment to measure the strength of the motion aftereffect for 2 different types of stimulus: (1) a black and white striped pattern that can move left or right and (2) a red and green striped pattern that can move left or right. The question is, does your brain's motion-detection system treat these two patterns differently?

a. Describe how you would test this using the method of adjustment. Draw possible results of this experiment (make sure to label the Y-axis and the X-axis). What are the disadvantages of this method?

Have the participant view the moving stripe stimuli, and then have them adjust the subsequent pattern until it appears to be stationary. The result graph would be a bar graph showing the point of adjustment to a perception of no motion, with the color on the x axis, and y axis being the speed relative to inducing stimulus. Disadvantages would be observer bias.

b. Describe how you would test this using the method of constant stimuli. Draw possible results of this experiment (make sure to label the Y-axis and the X-axis). What are the disadvantages of this method?

Test the subject at varying speeds and directions, both for the bar stimuli and the subsequent stimulus. Give them a 2 alternative forced choice about which direction the second stimulus is moving. From this, you should be able to calculate a psychometric curve resembling the one below, with speed relative to inducing stimulus on x axis, and probability response in one direction on y axis. The point of 50% probability is the point of subjective equality.
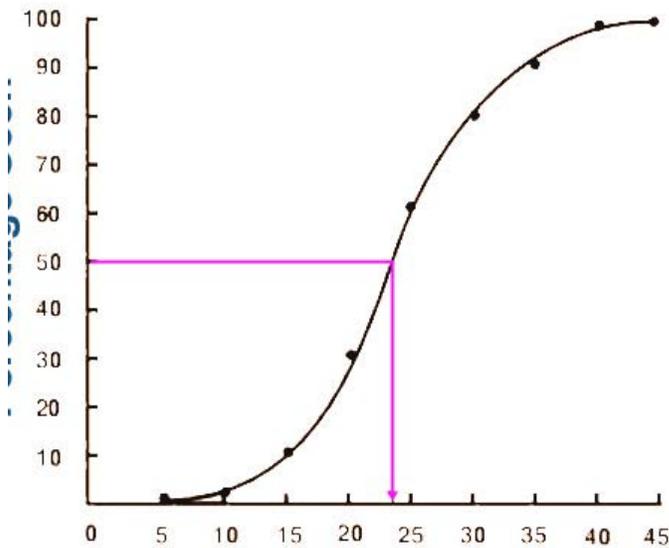
QUESTION 14 (10 pts):   Dr. Jones has a theory that the brain response to the first syllable of a word is different from the brain response to later syllables. She wants to test this hypothesis by having people listen to two-syllable words in the fMRI scanner. She will then compare the brain response when the subjects while listening to the first syllable, the second syllable, and during a fixation condition. She asks you for feedback on her experimental design.

a) What is the purpose of the fixation condition?
Provide a baseline for subtracting out background processes that don't have anything ot do with the task. (5pts)

b) You see one flaw in her design. What is it, and what change would you recommend? Assume that she has good earphones that get around any scanner noise issues.
fMRI does not have the temporal resolution to differentiate between syllables of the same word. The hemodynamic response is too coarse. This experiment would be better done with EEG or MEG. (5pts)

QUESTION 15 (10 pts):   It is said that people have different representations of letters and digits. In fact, when people search for a letter among digits, the letter seems to "pop-out" without the need for a serial search.

a) You test some people on a search task with a letter as the target and digits as the distractor (set size 3, 6, and 10). Draw the expected target absent and target present curves. Remember to label your axes.

b) Canadian postal workers spend a lot of time looking at Canadian postal codes, which intermix letters and digits. Therefore, they do not have this segregated representation of letters and digits. Draw the expected target absent and target present curves if you were to test them on the same search experiment. Explain any differences between these results and part a.
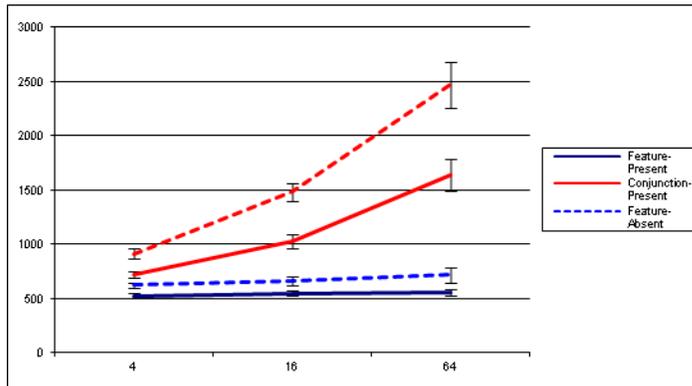
In part a, a "pop out" effect with no need for serial search means that you'll get basically a feature search curve. It would be like the blue lines. In part b, the search becomes a conjunction search, so you would get the red lines. The graph above is from coglab 2.

QUESTION 16 (10 pts):   You are using the method of limits to measure the threshold of auditory perception. You plan to do the following measurements (the units are arbitrary units of sound intensity).
1. Start from sound level 20 and get louder by 10 units at a time until detection.
2. Start from sound level 100 and get softer 10 units at a time until sound can no longer be detected.
3. Repeat steps 1 and 2 three times.
4. Average the thresholds measured at each step to come up with a final threshold measure.
What is wrong with your experiment? Justify your answer

With the method of limits, you have to start at different locations each time, or the subject might start learning the number of steps until the threshold.

The answer is NOT that:
1. units of 10 are too big, or that you need ot move at logarithmic steps. The units are arbitrary, so you don't know how big the steps are, and don't know whether or not it's a logarithmic scale.
2. Differences occur when you go up vs. going down. That is why you average the thresholds to get a final answer.

QUESTION 17 (10 pts):   Attention can be shifted both voluntarily and involuntarily.
a) Describe a spatial cueing paradigm that measures the effects of involuntary attention shifting on target detection time.
*Have something like a dot that flashes quickly before the actual target.*

b) How can you modify the experiment to measure the effects of voluntary attention shifting?
Have a higher level cue (like an arrow) that requires voluntary shifting of attention, rather than just automatic attention capture.

EXTRA QUESTIONS (FOR 10 EXTRA POINTS TOTAL) – YOU CAN CHOOSE ONE OF THE FOLLOWING 3 QUESTIONS 18,19, 20 OR ADD QUESTION 11 OR QUESTION 12

QUESTION 18 (10 pts):
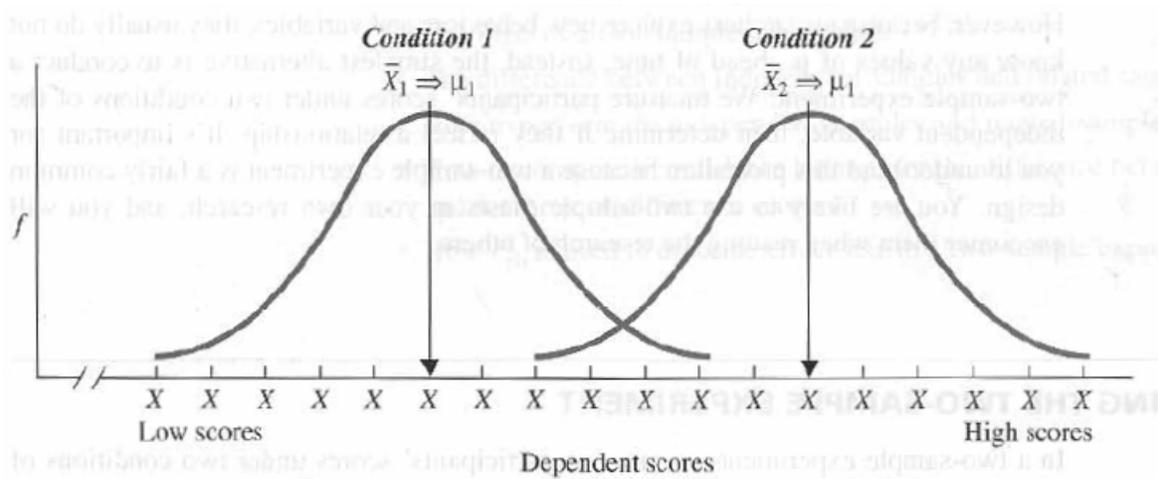
The above picture shows a hypothetical data set from an experiment with two conditions. The x axis represents test scores, and the y axis represents the number of people getting that score in each condition. A t test between the two gives a p value of $(p < .05)$
a) Another data set has the same difference in means between the two conditions. However, a t test returns a non-significant difference $(p > .40)$. Draw this data set.

T test is a difference of score
This would have curves centered at the same points, but wider with more overlap.

b) In a third experiment, you get a very small difference in means between the two experiments. However, the difference between the two populations is highly significant (p < .001). Draw this data set.

This would have curves centered at closer points, but with narrower peaks and no overlap.

QUESTION 19 (10 pts):   A prominent fmri researcher has discovered a brain region that responds selectively to images of donuts. You wonder whether this region represents all donuts as being the same, or if it differentiates between different flavors. Describe two fmri paradigms you can use to answer this question and explain how an experiment using each paradigm would work.

Subtraction paradigm: Have conditions of different flavors. See if activation in the area is greater for certain types of flavors vs. others

Repetition suppression: Show a continuous stream of donuts. If you show 2 in the row of the same flavor, do you get more suppression of activation in the donut area vs. when you show 2 in a row of different flavors?

OR

QUESTION 20 (10 pts):   Describe <u>an original experiment</u> (an idea of yours) that will test the role of background complexity on a visual search task (describe the hypotheses, independent factor(s), the dependant factor, the type of stimuli, the experimental procedure and the expected results).

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