

AMS5 - Final
Wednesday 9th June, 2010

READ THE INSTRUCTIONS CAREFULLY

1. Write your answers in a Blue Book. Write, *in ink*, your name, your student ID number, your section day/time and your TA's name on the front of your blue book.
2. Write the exam code (at the top right of this page) on the front of your blue book.
3. This exam consists of three (3) regular questions, and two (2) bonus questions.
4. You should answer all the regular questions. Questions are not necessarily worth equal numbers of marks.
5. You are advised to read the questions carefully, and answer the question asked.
6. Begin your answer to each question on a new page.
7. You must show working or give explanations for all questions to get full marks.
8. A normal table and a χ^2 -table can be found at the end of this exam.
9. Hand in this question paper with your answers.
10. Two of the questions have bonus parts, and there are two bonus questions. You can get full marks without answering the bonus questions. Correct answers to the bonus questions will earn you additional marks, but you cannot score more than 100%.

1. (12 marks) Read the summary of the article *“Did You See the Unicycling Clown? Inattentional Blindness while Walking and Talking on a Cell Phone”* printed at the end of this exam.

- (a) Was this an observational study or a controlled experiment? Explain briefly.
- (b) Give one hypothesis being tested in the first study.
- (c) Formulate this as a null hypotheses.
- (d) What was the hypothesis being tested in the second study?
- (e) Formulate this as a null hypothesis.

In the second study, 151 individuals who had walked across the main plaza of Western Washington University whilst a unicycling clown was present (see figure) were asked if they had seen the clown. The percentage of each group who did see the clown is given in the table, together with the total number of people in each group.

	cell phone user	single	MP3 user	pair
# of people	24	78	23	21
% who saw the clown	25.0	51.3	60.7	71.4

- (f) The 24 cell phone users can be considered to be a sample from which population?
- (g) What is a 95% confidence interval for the percentage of all cell phone users crossing the square who would notice the unicycling clown? Does the actual percentage lie in this interval?
- (h) Can you conclude that cell phone users notice the clown at a lower rate than single people?
- (i) Does the study demonstrate that using a cellphone whilst walking causes inattentional blindness?



2. (8 marks) During the quarter we ate two different brands of chocolate chip cookies, and counted the number of chocolate chips in each cookie.

For brand A, the mean number of chips was 28.9, with standard deviation 7.0.

For brand B, the mean number of chips was 27.1, with standard deviation 6.8.

- (a) Do you expect the distributions of the number of chips per cookie to follow the Normal curve? Explain briefly.

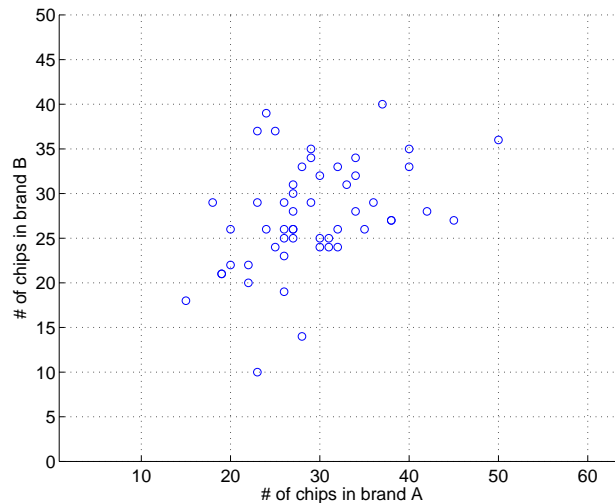
Because you sent me the number of chips in your cookie by SMS, I can match up the two counts that came from a particular individual, i.e., I have a data set that is two measurements (# of chips in your brand A cookie and # of chips in your brand B cookie) for each person. I have 54 such pairs of measurements.

I counted how many of these 54 had cookies which fell into each of the categories in the table below.

		Brand B		
		< 27 chips	≥ 27 chips	(total)
Brand A	< 29 chips	19	10	29
	≥ 29 chips	7	18	25
	(total)	26	28	54

- (b) Did people who got a lot of chips in their first cookie also get a a lot of chips in their second cookie?

The figure shows a scatter diagram of the # of chips in brand B vs. the # of chips in brand A. The correlation coefficient, r , is 0.40.



[CONTINUED]

- (c) One of you reported having 160 chips in your brand A cookie, and 99 in your brand B cookie. This is clearly an outlier, and is not included in the scatter plot above, nor in the calculation of r .

If it was included, would the correlation coefficient increase or decrease? Explain.

- (d) Someone else reported 160 chips in brand A, and 24 in brand B. Again, this was not included in the computation of r .

If it was included, would the correlation coefficient increase or decrease? Explain.

- (e) Some of you had 35 chips in your cookie of brand A. How many chips would you expect to have in your cookie of brand B?

- (f) What would the RMS errors in these estimates be?

- (g) **[BONUS]** (*2 marks*)

The cookies were handed out randomly – I had no way of arranging how many chips were in the cookies eaten by a given individual.

How do you explain the positive correlation between the number of chips reported for the two brands?

3. (12 marks) On the midterm, we considered an airline that flies aircraft with seats for four passengers. The airline had noted that someone who holds a ticket for a flight will show up for the flight 85% of the time.

The airline sells 4 tickets for every flight, and flies 200 trips per year.

- (a) Formulate a box model for the number of passengers on a given flight.
- (b) How many passengers does the airline expect to fly in a year?
- (c) What is the chance that the airline flies 700 or more passengers in a year?

Note that the mean of a box with more than two types of ticket, where the *proportion* of each type of ticket is known, is given by

$$\text{sum of } \left[\left(\begin{array}{c} \text{number on} \\ \text{the ticket} \end{array} \right) \times \left(\begin{array}{c} \text{fraction of the tickets} \\ \text{with that number} \end{array} \right) \right]$$

and the standard deviation is given by

$$\text{square root of } \left[\text{sum of } \left[\left(\left(\begin{array}{c} \text{number on} \\ \text{the ticket} \end{array} \right) - \left(\begin{array}{c} \text{mean of} \\ \text{the box} \end{array} \right) \right)^2 \times \left(\begin{array}{c} \text{fraction of the tickets} \\ \text{with that number} \end{array} \right) \right] \right]$$

The airline sells tickets for \$200 each, and flying the plane costs \$300 per trip. The purchase price of a ticket that is not used is refunded in full, and the plane must fly even if no passengers show up.

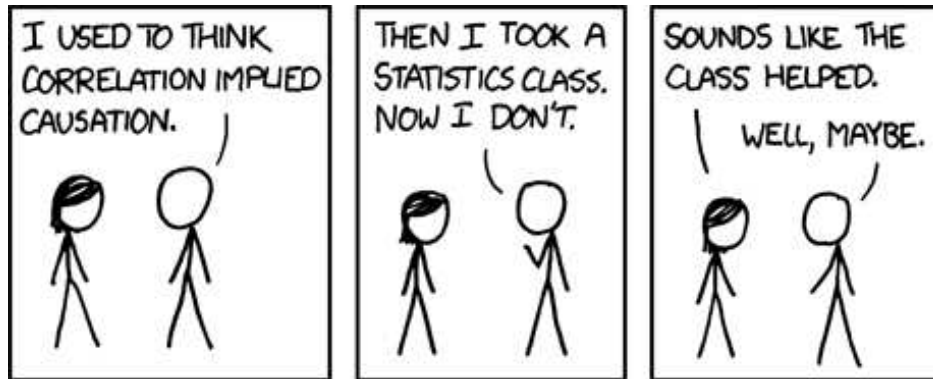
- (d) Formulate a box model for the profit the airline makes on a given flight.
- (e) What is the airline's expected profit for a year?

A manager notices that many flights are not full, and decides to start selling five (5) tickets for each flight. The airline refunds the ticket price for anyone who is denied boarding ("bumped"), and also pays them \$180 compensation. The airline succeeds in selling 5 tickets for each flight.

The probabilities of 0, 1, 2, 3, 4, 5 people showing up for a flight are now 0.0001, 0.002, 0.0244, 0.1382, 0.3915 and 0.4437.

- (f) Formulate a box model for the profit the airline now makes on a given flight.
- (g) What is the airline's expected profit for a year?
- (h) Should the airline sell four or five tickets for each flight?
- (i) [**BONUS**] (3 marks) The manager is paid a bonus if the airline makes more than \$80,000 per year. Should she sell 4 or 5 tickets per flight?
Is the manager's incentive tied to the best interests of the airline?

4. [BONUS] (1 mark) Why is the following cartoon¹ funny?



5. [BONUS] (1 mark) You are getting to know your new roommate, assigned to you by the college. In the course of a long conversation, you find that both of you have sisters named Deborah. Should you be surprised? Explain briefly.

¹xkcd.org

Did You See the Unicycling Clown? Inattentional Blindness while Walking and Talking on a Cell Phone

IRA E. HYMAN Jr*, S. MATTHEW BOSS, BREANNE M. WISE,
KIRA E. MCKENZIE and JENNA M. CAGGIANO

Western Washington University, USA

SUMMARY

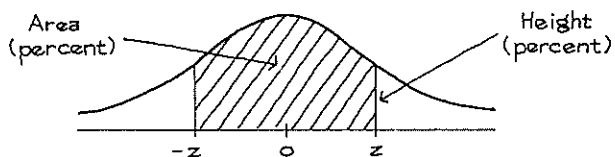
We investigated the effects of divided attention during walking. Individuals were classified based on whether they were walking while talking on a cell phone, listening to an MP3 player, walking without any electronics or walking in a pair. In the first study, we found that cell phone users walked more slowly, changed directions more frequently, and were less likely to acknowledge other people than individuals in the other conditions. In the second study, we found that cell phone users were less likely to notice an unusual activity along their walking route (a unicycling clown). Cell phone usage may cause inattentional blindness even during a simple activity that should require few cognitive resources. Copyright © 2009 John Wiley & Sons, Ltd.

In experiments using driving simulators, many researchers have found that people engaged in cell phone conversations show poorer driving performance than people focused only on driving. Although drivers may encounter a number of distractions, cell phones appear to be particularly problematic: Cell phone users perform more poorly than people listening to music, listening to books on tape, or conversing with a passenger (Crudell, Bains, Chapman, & Underwood, 2005; Drews, Pasupathi, & Strayer, 2008; Hunton & Rose, 2005; Strayer & Johnston, 2001). Strayer, Drews, and Crouch (2006) also found that engaging in a cell phone conversation results in poorer driving performance than being legally drunk. Nonetheless, many people still deny that such findings apply to them and argue that they perform just as well when using a cell phone. Strayer et al. noted that although their participants claimed they experienced no difficulties driving while talking on a cell phone, they nonetheless performed more poorly in the simulated driving task they had just completed.

Trick, Enns, Mills, and Vavrik (2004) framed how divided attention may impact driving performance. They noted that some aspects of driving, such as maintaining lane position, are relatively automatic, require little attentional capacity, and may not be affected by divided attention tasks—an observation subsequently reported by other researchers studying the effects of cell phone conversations on driving performance in a simulator (Horrey & Simons, 2007; Kubuse, Bock, Dell, Garnsey, Kramer, & Mayhugh, 2006; Rakauskas, Gugerty, & Ward, 2004). Other aspects of driving require greater attentional

*Correspondence to: Ira E. Hyman, Jr, Psychology Department, Western Washington University, 516 High St., Bellingham, WA 98225, USA. E-mail: Ira.Hyman@wwu.edu

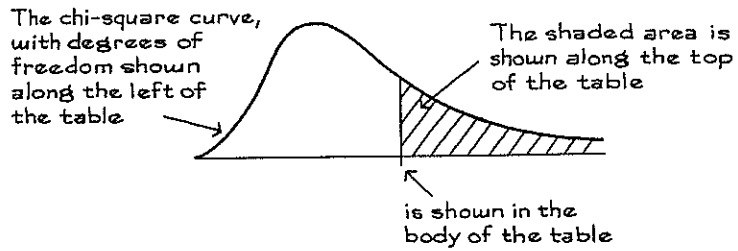
Tables



A NORMAL TABLE

<i>z</i>	<i>Height</i>	<i>Area</i>	<i>z</i>	<i>Height</i>	<i>Area</i>	<i>z</i>	<i>Height</i>	<i>Area</i>
0.00	39.89	0	1.50	12.95	86.64	3.00	0.443	99.730
0.05	39.84	3.99	1.55	12.00	87.89	3.05	0.381	99.771
0.10	39.69	7.97	1.60	11.09	89.04	3.10	0.327	99.806
0.15	39.45	11.92	1.65	10.23	90.11	3.15	0.279	99.837
0.20	39.10	15.85	1.70	9.40	91.09	3.20	0.238	99.863
0.25	38.67	19.74	1.75	8.63	91.99	3.25	0.203	99.885
0.30	38.14	23.58	1.80	7.90	92.81	3.30	0.172	99.903
0.35	37.52	27.37	1.85	7.21	93.57	3.35	0.146	99.919
0.40	36.83	31.08	1.90	6.56	94.26	3.40	0.123	99.933
0.45	36.05	34.73	1.95	5.96	94.88	3.45	0.104	99.944
0.50	35.21	38.29	2.00	5.40	95.45	3.50	0.087	99.953
0.55	34.29	41.77	2.05	4.88	95.96	3.55	0.073	99.961
0.60	33.32	45.15	2.10	4.40	96.43	3.60	0.061	99.968
0.65	32.30	48.43	2.15	3.96	96.84	3.65	0.051	99.974
0.70	31.23	51.61	2.20	3.55	97.22	3.70	0.042	99.978
0.75	30.11	54.67	2.25	3.17	97.56	3.75	0.035	99.982
0.80	28.97	57.63	2.30	2.83	97.86	3.80	0.029	99.986
0.85	27.80	60.47	2.35	2.52	98.12	3.85	0.024	99.988
0.90	26.61	63.19	2.40	2.24	98.36	3.90	0.020	99.990
0.95	25.41	65.79	2.45	1.98	98.57	3.95	0.016	99.992
1.00	24.20	68.27	2.50	1.75	98.76	4.00	0.013	99.9937
1.05	22.99	70.63	2.55	1.54	98.92	4.05	0.011	99.9949
1.10	21.79	72.87	2.60	1.36	99.07	4.10	0.009	99.9959
1.15	20.59	74.99	2.65	1.19	99.20	4.15	0.007	99.9967
1.20	19.42	76.99	2.70	1.04	99.31	4.20	0.006	99.9973
1.25	18.26	78.87	2.75	0.91	99.40	4.25	0.005	99.9979
1.30	17.14	80.64	2.80	0.79	99.49	4.30	0.004	99.9983
1.35	16.04	82.30	2.85	0.69	99.56	4.35	0.003	99.9986
1.40	14.97	83.85	2.90	0.60	99.63	4.40	0.002	99.9989
1.45	13.94	85.29	2.95	0.51	99.68	4.45	0.002	99.9991

A CHI-SQUARE TABLE



Degrees of freedom	99%	95%	90%	70%	50%	30%	10%	5%	1%
1	0.00016	0.0039	0.016	0.15	0.46	1.07	2.71	3.84	6.64
2	0.020	0.10	0.21	0.71	1.39	2.41	4.60	5.99	9.21
3	0.12	0.35	0.58	1.42	2.37	3.67	6.25	7.82	11.34
4	0.30	0.71	1.06	2.20	3.36	4.88	7.78	9.49	13.28
5	0.55	1.14	1.61	3.00	4.35	6.06	9.24	11.07	15.09
6	0.87	1.64	2.20	3.83	5.35	7.23	10.65	12.59	16.81
7	1.24	2.17	2.83	4.67	6.35	8.38	12.02	14.07	18.48
8	1.65	2.73	3.49	5.53	7.34	9.52	13.36	15.51	20.09
9	2.09	3.33	4.17	6.39	8.34	10.66	14.68	16.92	21.67
10	2.56	3.94	4.86	7.27	9.34	11.78	15.99	18.31	23.21
11	3.05	4.58	5.58	8.15	10.34	12.90	17.28	19.68	24.73
12	3.57	5.23	6.30	9.03	11.34	14.01	18.55	21.03	26.22
13	4.11	5.89	7.04	9.93	12.34	15.12	19.81	22.36	27.69
14	4.66	6.57	7.79	10.82	13.34	16.22	21.06	23.69	29.14
15	5.23	7.26	8.55	11.72	14.34	17.32	22.31	25.00	30.58
16	5.81	7.96	9.31	12.62	15.34	18.42	23.54	26.30	32.00
17	6.41	8.67	10.09	13.53	16.34	19.51	24.77	27.59	33.41
18	7.00	9.39	10.87	14.44	17.34	20.60	25.99	28.87	34.81
19	7.63	10.12	11.65	15.35	18.34	21.69	27.20	30.14	36.19
20	8.26	10.85	12.44	16.27	19.34	22.78	28.41	31.41	37.57

Source: Adapted from p. 112 of Sir R. A. Fisher, *Statistical Methods for Research Workers* (Edinburgh: Oliver & Boyd, 1958).