Signature PRINTED NAME

Math 210 **Exam 1** Jerry L. Kazdan
October 16, 2008 9:00 — 10:20

DIRECTIONS: Part A has 4 shorter problems (10 points each) while Part B has 4 problems (15 points each). To receive full credit your solution should be clear and correct. You have 1 hour 20 minutes. Closed book, no calculators, but you may use one 3 ×5 with notes on both sides. Please box your answers.

PART A: SHORTER PROBLEMS 40 POINTS (10 POINTS EACH)

A-1. What day of the week was January 9, 2004? [In case it helps, December 31, 2000 was a Sunday].

A-2. The next three players in a game win 30%, 35% and 25% of the time, respectively. What is the likelihood that at least one of them will win this time?
[EQUIVALENT WORDING: It is the fifth inning of a baseball game. The batting averages of the next three batters are .300, .350, and .250. Say they face an average pitcher. What is the likelihood that at least one of them will get a hit this inning?]

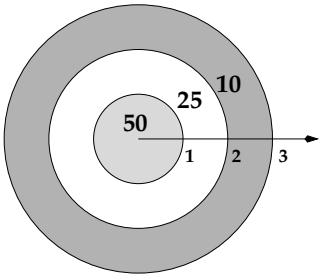
A-3. In a Table of Life Expectancies, one finds that in a population of 100,000 females, 90% can expect to live to age 60, while 65% can expect to live to age 80. Given that a woman is 60, what is the probability that she lives to age 80?

Score	
A-1	
A-2	
A-3	
A-4	
B-1	
B-2	
B-3	
B-4	
Total	

A-4. Someone picks two random numbers s and t in the interval $0 \leq x < 1$. What is the probability that $s \geq t^2$?

PART B: 60 POINTS (15 POINTS EACH)

B-1. A big dart board consists of three concentric disks of radius 1, 2, and 3 feet. If a dart lands in the center disk you get 50 points. If it lands in the middle ring you get 25 points, while if it lands in the outer ring you get 10 points.



a). What is the probability that a randomly thrown dart will land in the outer ring?

b). What is the expected number of points you will get for a randomly thrown dart?

B-2. During a power blackout, a group of people are arrested on suspicion of looting. Each is given a polygraph test. From past experience it is known that this polygraph test is 90% reliable when administered to a guilty suspect and 98% reliable when given to those who are innocent. Suppose that of every group of suspects, only 12% are actually involved in any wrongdoing.

a) What is the probability that someone who is innocent fails the test (false positive)? What is the probability that someone who is guilty passes the test (false negative)?

b) If the polygraph says a suspect is guilty, what is the probability that the suspect is actually innocent?

B-3. In an experiment, at time t you measure the value of a quantity R and obtain:

t	-1	0	1	2
R	-1	1	1	-3

Based on other information, you believe the data should fit a curve of the form $R = a+bt^2$.

a) Write the (over-determined) system of linear equations you would like to solve ideally for the unknown coefficients a and b.

b) Use the method of least squares to find the *normal equations* for the coefficients a and b.

c) Explicitly find the coefficients a and b.

B-4. The following was used to produce a form on a web page:

```
<html><head><title>computation</title></head>
<body bgcolor=white>
<center>  <h2>Math 210 Using Perl to Compute (A + B)/C</h2>
<form action="/cgi-bin/computation.pl"> </center>
You specify:
<center>    <b>A = </b><input type=text name="A" size=15>
        <br><b>B = </b><input type=text name="B" size=15>
        <br><b>C = </b><input type=text name="C" size=15></center>
<p>
This computes: <b>(A + B)/C</b>.
<center><input type=submit value="Submit"></center>
</form>
</body></html>
```

Your task: write a follow-up perl script that does this computation and returns the result as a web page. Your script should *first* check of the denominator is zero. If so, instead of doing the computation it gives an appropriate error message. [Better version (not asked here): also check if both of the input variables are honest numbers: no alphabetical characters or symbols].

In case it helps, a sample perl script is on the next page.

REFERENCE: *Sample Perl Script With Input From a Form*

```
#!/usr/bin/perl
push(@INC,"/home/httpd/cgi-bin");
require "cgi-lib.pl";
#------------------------ Sample Perl Script ----------------------------
# Input data:  x,  y.    Output: x + y
#---------------------------- Main Program ----------------------------
&ReadParse;
print &PrintHeader;
$z = $in{x} +  $in{y};

print <<"end";
<html><head><title>Math 210, Perl Example 1</title></head>
<body bgcolor=white>
<center><h2> Output for Example 1</h2>

<i>Your input</i>:  <b> x = $in{x}, y = $in{y}</b>
<p>
<i>Answer</i>: <b>x + y = $z</b>
</center></body></html>
end
```