There are 17 multiple choice problems worth 6 points each.

‘An Aggie does not lie, cheat or steal or tolerate those who do.’

Good Luck!

1. On your scantron be sure you have filled in your UIN and your name and section or classtime.

2. Make sure your test form B is on your scantron.

3. Circle your answers on the test form and bubble the scantron. You will not get the scantron back.

4. Do not open this page until told to do so.
1. A sample space is $S = \{a, b, c, d\}$. $P(a) = .2$  $P(\{a, b, c\}) = .7$  and $P(\{c, d\}) = .7$.
What is $P(b)$?

- a) .3
- b) .5
- c) .4
- d) .2
- e) .1

$P(\{a, b, c\}) = .7$ so $P(d) = 1 - .7 = .3$

And $P(\{c, d\}) = .7$ so $P(c) = .7 - .3 = .4$

$P(b) = P(\{a, b, c\}) - P(a) - P(c) = .7 - .2 - .4 = .1$

2. Each of six people secretly chooses a whole number between 1 and 10 inclusive. Find the probability at least two of them choose the same number.

- a) .5267
- b) .1512
- c) .9975
- d) .9999
- e) .8488

This is like the birthday problem.

$1 - P(\text{all choose different numbers})$

$= 1 - \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6}{10^6} = .8468$
3. A person studies the photos and names of 30 people until he can recognize and name exactly 25 of them. If the person is shown 10 of the people, what is the probability he can name at least 9 of them?

\[ \text{Possibilities:} \quad \begin{array}{ccc} \text{Knows 25} & \text{Knows not 5} \\ \text{Choose} & 9 & 1 \\ \text{or} & 10 & 0 \end{array} \]

\[ \frac{\binom{25}{9} \binom{5}{1} + \binom{25}{10}}{\binom{30}{10}} = .45 \]

4. A group of 300 people was studied to determine if there is a relationship between a certain gene and a certain disease. \( A \) is the event that a person in the group has the gene. \( D \) is the event that a person in the group has the disease. The table shows the composition of the group.

<table>
<thead>
<tr>
<th></th>
<th>( A )</th>
<th>( A^c )</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>( D )</td>
<td>30</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>( D^c )</td>
<td>150</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>total</td>
<td>180</td>
<td>120</td>
<td>300</td>
</tr>
</tbody>
</table>

\[ P(D) = \frac{150}{300} = \frac{1}{2} \]

\[ P(A) = \frac{180}{300} = \frac{6}{10} \]

\[ P(D \cap A) = \frac{30}{300} = \frac{1}{10} \]

\[ P(A) \cdot P(D) = \frac{1 \cdot 6}{10 \cdot 10} = \frac{1}{25} \]

\[ A, D \text{ are indep.} \]

Which of the following statements is/are true? Choose the best answer.

a) The study indicates that having the gene changes the probability of having the disease. No, indep.

b) \( A \) and \( D \) are independent. True

c) \( A \) and \( D \) are mutually exclusive. No since \( n(A \text{ and } D) = 30 \) is not 0.

d) both b and c are true

e) \( P(D | A) = \frac{3}{5} \) no by indep, \( P(D | A) = P(D) = \frac{1}{6} \)
5. A and B are two events in a sample space. \( P(A) = .5 \) \( P(B) = .7 \) and \( P(A \cup B) = .8 \). Find \( P(A|B) \).

\[
\begin{align*}
a) \quad & \frac{5}{7} \\
b) \quad & \frac{2}{3} \\
c) \quad & \frac{5}{8} \\
d) \quad & \frac{4}{5} \\
e) \quad & \frac{4}{7}
\end{align*}
\]

\[
P(A \cap B) = P(A) + P(B) - P(A \cup B) = .5 + .7 - .8 = .4
\]

\[
P(A|B) = \frac{\frac{4}{7}}{.4} = \frac{4}{7}
\]

6. Three game players compete with a computer. The probabilities that players I, II and III will individually beat the computer are 0.6, 0.8 and 0.5 respectively. Each gamer is isolated with the computer and plays against it. What is the probability that at least one of the gamers beats the computer?

\[
\begin{align*}
e) \quad & .96 \\
b) \quad & .76 \\
c) \quad & 1.9 \\
d) \quad & .26 \\
e) \quad & .74
\end{align*}
\]

\[
1 - P(\text{none beat the comp}) = 1 - (0.4)(0.2)(0.5) = 0.96
\]
Information for 7, 8, and 9: Three companies A, B and C provide all of the washing machines in a certain region. Company A provides 35%, company B provides 20% and company C provides 45% of all the machines. The probabilities that company A, B or C machines will need repairs are 0.02, 0.05 and 0.06 respectively.

7. Find the probability that a company C machine does not need repairs.
   a) 0.423   b) 0.442   c) 0.325   d) 0.94   e) none of these

8. Find the probability that a randomly selected washing machine will need repairs.
   a) 0.130   b) 0.050   c) 0.044   d) 0.043   e) none of these
   \[
   P(R^c/C) = \frac{(0.35)(0.02) + (0.2)(0.05) + (0.45)(0.06)}{0.044}
   \]

9. Find the probability that a machine that needs repairs was made by company A.
   a) 0.159   b) 0.20   c) 0.007   d) 0.37   e) 0.14
   \[
   \frac{(0.35)(0.02)}{0.044} \approx 0.159
   \]
Information for 10 and 11: A box contains 2 red and 4 blue balls. A person chooses a ball from the box. If it is red he returns it to the box. If it is blue he does not return it. Then he chooses a second ball. The random variable, $X$, is the number of red balls chosen.

10. Find $P(X = 1)$.
   
   a) .2222  
   b) .4889  
   c) .5333  
   d) .2667  
   e) .4444

   
   \[
   P(X=1) = P(\text{1st red and 2nd blue}) + P(\text{1st blue and 2nd red}) \\
   = \frac{1}{3} \cdot \frac{2}{3} + \frac{2}{3} \cdot \frac{2}{5} \\
   \approx .4889
   \]

11. Find $E(X)$, the expected value of $X$.

   a) 2.00  
   b) 1.00  
   c) .71  
   d) .60  
   e) none of these

   
   \[
   \begin{array}{c|cc}
   x & 0 & 1 & 2 \\ 
   \hline
   P(x) & \frac{2}{5} & \frac{2}{9} & \frac{1}{9} \\
   \hline
   \end{array}
   \]

   \[
   \text{1 var Stats: L1, L2} \quad \bar{x} \approx .71
   \]

   or by hand $E(X) = \bar{x} = 0 \cdot \frac{2}{3} + 1 \cdot \frac{2}{9} + 2 \cdot \frac{1}{9} \\
   = \frac{32}{45} = .71$
12. Classify each random variable, $F$, $G$ and $H$ as finite discrete, infinite discrete, or continuous.

An elevator has a capacity of 10 people and can make 30 trips per hour. $F$ is the number of people on the elevator between 5 pm and 6 pm on a given day. $F$ is finite discrete.

$G$ is the unrounded time it takes a runner to run 5 miles. $G$ is continuous.

A person tosses a die until a 4 shows on top. $H$ is the number of times he tosses the die.

a) All three random variables are continuous.

b) $F$ is is infinite discrete, $G$ is finite discrete and $H$ is continuous.

c) $F$ is finite discrete, $G$ is continuous and $H$ is infinite discrete.

d) All three random variables are infinite discrete.

e) $F$ and $H$ are finite discrete and $G$ is continuous.

13. The odds that a certain horse will win a certain race are $2 : 3$. The probability he will win is

\[
\frac{2}{3} \quad b) \quad \frac{1}{3} \quad c) \quad \frac{3}{5} \quad d) \quad \frac{2}{5} \quad e) \quad \frac{1}{2} \quad \frac{2}{2+3}
\]

14. The table shows the scores on a 3-point quiz.

<table>
<thead>
<tr>
<th>Score</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>#Students</td>
<td>10</td>
<td>15</td>
<td>25</td>
<td>10</td>
</tr>
</tbody>
</table>

Find the mean, median, and standard deviation of the scores.

a) mean = 1.583  median = 2  stdev = 0.9538

b) mean = 1.5  median = 2  stdev = 1.118

c) mean = 1.5  median = 1.5  stdev = 1.118

d) mean = 1.583  median = 1.5  stdev = 0.9618

e) mean = 1.5  median = 1.5  stdev = 1.291

Depending on your calculator:

- 1 Var Stats L1
- Freq L2
- or 1 Var Stats L1 L2

15. A box contains 10 red and 5 blue balls. Which experiment is binomial?

a) A person chooses two at a time with replacement. This is repeated 6 times. \( X \) is the number of blue balls chosen. \( \text{Trials are not Bernoulli} \)

b) A person chooses 6 balls in succession without replacement and observes the number of red balls chosen. \( \text{Not independent or identical} \)

c) A person chooses in succession without replacement until a red is chosen and observes the number of blue balls chosen. \( \text{Not a set # of trials} \)

d) A person chooses 6 in succession with replacement and observes the number of red chosen

e) all of the above.

Information for 16 and 17: A multiple choice test has 12 questions with 4 possible answers for each, 1 correct answer and 3 incorrect answers. A person randomly guesses on each question. The random variable, \( X \), is the number of questions he answers correctly.

16. Find the expected value of \( X \) and the probability that \( X \) is equal to this number.

\[
\begin{align*}
E(X) &= 4, \quad P(X = 4) = 0.6315 \\
E(X) &= 3, \quad P(X = 3) = 0.2581 \\
E(X) &= 4, \quad P(X = 4) = 0.2384 \\
E(X) &= 3, \quad P(X = 3) = 0.6488 \\
\text{e) none of these}
\end{align*}
\]

\[E(X) = np = 12 \cdot \frac{1}{4} = 3\]

\[P(X = 3) = \text{binompdf}(12, \frac{1}{4}, 3) \approx 0.2581\]

17. Find the probability that he answers at least 5 questions correctly.

\[a) 0.1576 \quad b) 0.8424 \quad c) 0.0544 \quad d) 0.3685 \quad e) 0.1777\]

\[1 - \text{binomcdf}(12, \frac{1}{4}, 4) \approx 0.1576\]