MATH 101 Rec. no. _____

Test 2 Name: _____

Form A Signature: _____

XXXXXXXXXXXXXXX Student no: _____

Recall that we will have several probability questions: On identifying mutually/not mutually events, independent and dependent events; and the use of the AND and OR formulas for those types of problems.

The remainder of the test will be on Chapter 2. Consider the which is FALSE questions carefully. You won't get as many on the test, but you will get some.

Recall, that I will ask for the negation of an implication too.

As usual, you get a couple extra problems to reinforce ideas that I think are important.

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1. A public interest group investigates the possibility of fraud in the packaging and labeling of *Carl's Cashews* nuts. They tested 2,000 packages of the nuts which were advertised as containing 3.6 ounces. From their test they computed a confidence interval at the 0.95 confidence level. They obtained an interval of 3.45 ounces plus or minus 0.2 ounces. Which of the following is **FALSE**.
   Note that the advertised weight is 3.6 oz, that doesn't mean that every package is exactly 3.6, the weights are probably normally distributed, 3.6 oz is the mean weight of all packages (the parameter =μ in this study.

   (a) There is a 0.95 probability that the mean weight of all packages is between 3.25 and 3.65 ounces.
   TRUE: that's what it means to be a confidence interval for μ, the mean weight over all packages.

   (b) They should conclude that the packages are probably properly labeled.
   TRUE: The claimed mean of $\mu = 3.6$ lies within the confidence interval

   (c) There is a 0.95 probability that any particular package of nuts will weigh between 3.25 and 3.65 ounces.
   FALSE: Estimates of the mean μ, even μ itself, doesn't tell you about a particular data point.

   (d) The actual mean weight of all packages may not be between 3.25 and 3.65 ounces.
   "TRUE: there is a 1-0.95=0.05 probability that the parameter μ does not lie with in the interval

   (e) The sample was from the correct population.
   TRUE: they used 2,000 packages from the population.

2. Which of the following statements about samples and populations is **FALSE**.

(a) The mean over any sample will be the same as the mean over the population.
FALSE: it is an estimate - that's why we have a confidence interval (range of values + a probability that the mean is in that interval).

(b) We expect the standard deviation of measurements from a sample to be smaller than the standard deviation of the population.
TRUE: That's reflected in the estimate $\hat{\sigma} = S\sqrt{n/(n-1)}$

(c) Sample is to statistic, as population is to parameter.
TRUE: a statistic is a mean from a sample, and the parameter is the mean of the population.

(d) A sample should be a subset of the population.
TRUE: just makes sense doesn't it?

(e) Sample data is used to estimate information about the population.
TRUE: this was the whole point of the time we spent on statistical testing.

3. In a χ^2 test a researcher has a table with three rows and four columns, where the researcher knows in advance the totals of each row and column. How many degrees of freedom does this test have?

(a) 2 (d) 5
(b) 3 (e) 6
(c) 4

6 = (no. of cols -1)(no. of rows -1)=(3-1)(4-1)=2(3)

4. A researcher is preparing the *expected* values table to test the reported statistic that 64% of eligible students plan to vote in the national election on Nov 2. If she asks 218 eligible students, and all responded Yes or No, then what should her expected value be for the number of students who **do not** plan to vote in the election?

(a) 139.52 (d) 36
(b) 78.48 (e) None of these
(c) 64

64% say yes, so 36% said No. Now, 36% of 218 is (0.36)(218) = 78.48. SO I get (b).

5. For the distributions below, compute the χ^2 statistic.

Observed		
A	B	C
23	17	21

Expected		
A	B	C
31	18	12

(a) .835 (d) 6.699
(b) 1.064 (e) 8.870
(c) 2.065

The statistic is

$$\begin{aligned}\chi^2 &= \frac{(E_1-F_1)^2}{E_1}+\frac{(E_2-F_2)^2}{E_2}++\frac{(E_3-F_3)^2}{E_3}\\ &= \frac{(31-23)^2}{31}+\frac{(18-17)^2}{18}+\cdots+\frac{(12-21)^2}{12}\\ &== \frac{(8)^2}{31}+\frac{(1)^2}{18}+\cdots+\frac{(9)^2}{12}\\ &= 8.8701\end{aligned}$$

So I get (e).

6. Suppose that we have considered both the observed and expected distributions for a χ^2 statistic, and that we have chosen $\alpha = 0.025$ and found $d = 3$. Which of the following statements is FALSE.
Note that the entry is 9.348 for $d = 3$ and $\alpha = 0.025$. We reject if a statistic is larger and do not reject if it is smaller.

   (a) The larger the χ^2 statistic is the more unlikely it is that the differences between the observed and expected distributions are due to chance.
   TRUE: In other words, the larger the χ^2 statistic is, the MORE likely it is that there is a significant difference.

   (b) If the χ^2 statistic is larger than 9.348 then we will reject our null hypothesis.
   TRUE

   (c) If the χ^2 statistic is 0.2, then we will not reject the null hypothesis.
   TRUE

   (d) It is possible that the conclusions drawn from a χ^2 will be in error.
   TRUE: there is an $\alpha = 0.025$ probability that we are wrong, that is, we got a non-representative sample.

   (e) If the χ^2 statistic is 13.687 then we will not reject the null hypothesis.
   FALSE

7. Which of the following is not a logical statement?

   (a) The Pythagorean theorem applies to right triangles.

   (b) The President of the USA is a member of the Libertarian Party.

   (c) Math 101 is useful for all students.
   No. This is an opinion, mine as a matter of fact, not a logical statement. The answer will differ from person to person. Some of the other statements are little silly, but they are logical statements. (e) is False, Mexico isn't a palnet.

   (d) Burnt sienna is a shade of the color red.

   (e) Mexico is one of the nine planets in our solar system.

8. Which of the following is a conjunction?
Which is an AND statment?

(a) Feta cheese is made from goat's milk.

(b) Peanuts are a lugume and cashews are from a conifer.

(c) Denver is in Colorado or Pheonix is in Arizona.

(d) If gas gets cheaper, then people will drive more.

(e) Onion soup tastes awful.

9. Which of the following is logically equivalent to *if James passes his test, then he will pass his course.*?
The contrapositive - (c).

(a) If James does not pass his test, then he will not pass his course.

(b) If James passes his course then he passed his exam.

(c) If James does not pass his course, then he did not pass his test.

(d) James passes his test and does not pass his course.

(e) James does not pass his exam and does pass the course.

12. Which of the following means the same thing as *None of my students will fail this test*?
NONE means ALL WILL NOT - it incorporates universal quantification and negation of the verb into one word. Answer is (b)

1. Some of my students will not fail this test.
2. All of my students will not fail this test.
3. Some of my students will fail this test.
4. All of my students will fail this test.
5. None of my students will pass this test.

13. What is the negation of the following implication: *if it is a math textbook, then it costs more than $60*?
Negation of an implication is an AND statement.
Promise model - the negation is
you did what you were supposed to (the first part or antecedent is True)
AND
you did not get what you were supposed to get (the second part or consequent is False)
Answer is (d)

1. If it is a math textbook then it does not cost more than $60.
2. It is a math textbook and it costs more than $60.
3. It is a math textbook or it costs more than $60.
4. It is a math textbook and it does not cost more than $60.
5. It is a math textbook or it does not cost more than $60.

14. Which of the following general statements about inductive and deductive reasoning is **FALSE**

    1. If the premise is true, then conclusions reached by deductive reasoning will always be true.
       TRUE: This is the main advantage of deductive reasoning over inductive, and the basis for interpreting business, legal and ppersonal agreements.
    2. Inductive reasoning usually involves generalizing from examples.
       TRUE.
    3. Direct and indirect arguments are forms of deductive reasoning.
       TRUE
    4. Conclusions reached by inductive reasoning are always true.
       FALSE. Inductive reasoning is based on experience, and that is always limited.
    5. A statistical test is a sophisticated form of inductive reasoning.
       TRUE: We are making conclusions about populations by only looking at some examples or samples. We are generalizing from limited information.

15. Consider the following argument.

Premise: If Janine is late for class, then she will miss the quiz.
Janine did not miss the quiz.

Conclusion: Janine is not late for class.

What type of reasoning is used in this argument?

1. Inductive reasoning.
2. Direct reasoning.
3. Indirect reasoning.
   Moved "backwards" through the implications using negations.
4. Transitivity.
5. Fallacious reasoning.

16. Find a conclusion which can be reached using all of the following premises.

    If Joan gets a raise, then she will buy a new car.
    Joan will get a raise or she will be fired.
    If Joan is fired, then she will go back to school.
    Joan did not get fired.

    The ONE true statement we have that is simple is ***Joan did not get fired*** *SO the third statement can't be used!!! We can use the second statement to conclude* ***Joan Got a raise*** *since the OR statement is True and she didn't get fired. Now since Joan got a raise we can also conclude* ***She will buy a new car*** *using the fist statement. We got Two conclusions": Joan got a raise and Jaon will but a new car. However we can't use the third statement at any point. So the answer is the tricky (e).*

1. Joan did not get a raise.
2. Joan got fired.
3. Joan went back to school.
4. Joan did not buy a new car.
5. No conclusion using all of the premises can be made.

21. You roll two dice. What is the probability that one, but not both, of the dice turns up a 6?
Think of two dice - one Red and one Green. There are 36 ways for the dice to turn up individual numbers on each of the pair - not sums here. Let A = the event ***the Red die is a 6*** *and B= the event* ***the Green die is a 6*** *There are 6 ways, out of 36 outcomes for each of these to be true - so Prob(A)=Prob(B)=*$\frac{6}{36}$*. But the pair* ***double 6's*** *is counted twice, that is Prob(A and B)=*$\frac{1}{36}$ *and Prob(A or B) = Prob(A) +Prob (A) -Prob(A and B)* $= \frac{6}{36} + \frac{6}{35} - \frac{1}{36} = \frac{11}{36} = 0.03056$

1. 0.0278
2. 0.0667
3. 0.3056
4. 0.2778
5. 0.9722

22. Consider the experiment of drawing a random card from a standard deck of 52 cards. The events *you draw a red card or you draw a numbered card* are what type of events?
OR indicates - it is a question about exclusive events. Since both things can happen at the same time they are Not Mutually Exclusive - (d)

1. independent events
2. dependent events
3. mutually exclusive events
4. not mutually exclusive events
5. none of the above four choices.

23. What is the probability of drawing 2 Aces in a row and then a King from a standard deck of 52 cards, if you do NOT replace the cards?
Dependent sequence of events, the number of cards changes after each successful step of the sequence of three events.
Prob = Prob(First ace) $\cdot$ *Prob(Second ace)* $\cdot$ *Prob(First king)* $=(\frac{4}{52}) \cdot (\frac{3}{51}) \cdot \frac{4}{50} =$ 0.00036199 *I'd probably leave this as a product of fractions.*

24. On a particular day there is a 50% chance of rain, a 80% chance of rain or high winds, and an 60% chance of high winds and rain. What is the chance of high winds? [Hint: change to probability - this is a Prob(A or B) = Prob(A)+Prob(B) -Prob(A and B) problem.]

Let A be it rains, B you get high winds, change the numbers and put them in the equation to solve for the unknown

$$\begin{array}{ccccc} Prob(AorB) = & Prob(A) & +Prob(B) & -Prob(AandB) \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow \\ 0.80 = & 0.50 & +Prob(B) & -0.60 \end{array}$$

You should get 0.90 probability, so 90% chance