Name: _____

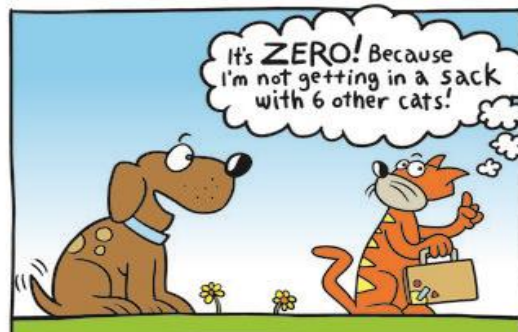| Problem	1 / 2 / 3	4 / 5	6	7 / 8	Total
Possible	31	30	26	13	100
Received					

DO NOT OPEN YOUR EXAM UNTIL TOLD TO DO SO.

You may use a 3 x 5 card of notes, both sides, and a calculator.

FOR FULL CREDIT, SHOW ALL WORK RELATED TO FINDING EACH SOLUTION.
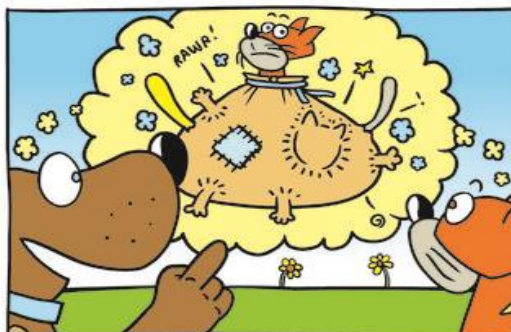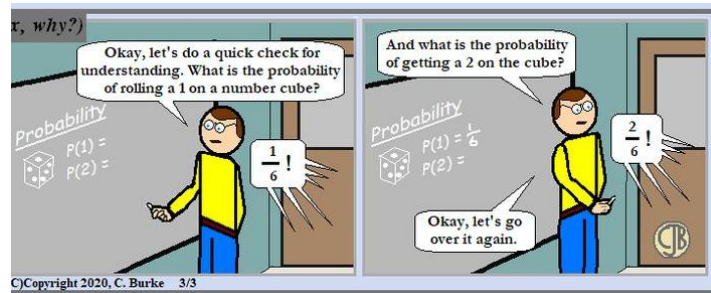
14 points   1. Suppose we roll two 5-sided dice, numbered 1 to 5. We are interested in the sum.

Event E is "sum is ≥ 6"

Event F is "sum is odd"

Sum of 2 dice

	1	2	3	4	5
1	2	3	4	5	6
2	3	4	5	6	7
3	4	5	6	7	8
4	5	6	7	8	9
5	6	7	8	9	10

/2 $\Pr(E) =$

/2 $\Pr(F) =$

/2 $\Pr(E \cap F) =$

/2 $\Pr(E \cup F) =$

/2 $\Pr(E|F) =$

/2 $\Pr(F|E) =$

/2 Are events E and F independent? Explain why or why.

12 points   2. Suppose that $\Pr(E) = .4, \Pr(F) = .5, \Pr(E \cap F) = .2$.

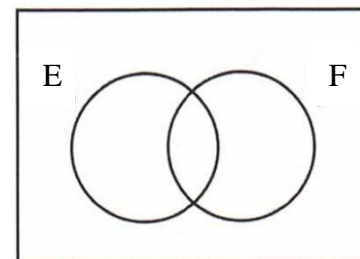Find each of the following.

/2 $\Pr(E \cup F) =$

/2 $\Pr(E' \cap F) =$

/3 $\Pr(F|E') =$

/3 $\Pr(E'|F') =$

/2 Are events E and F independent? Explain why or why not.

5 points   3. Suppose 4 persons each randomly, independently choose a number between 1 and 20.
What is the probability that 2 or more of their numbers match?

15 points 4. Suppose that 10 standard (6-sided, with numbers 1 to 6) dice are rolled. What is the probability that you get:

/3 No 4's:

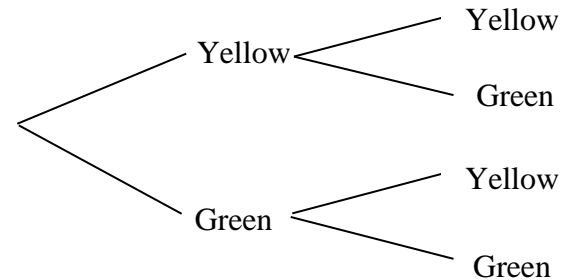/5 Three 4's:

/3 At least one 4:

/4 Suppose that someone tells you that at least one die is a 4. What is the probability that you got exactly three 4's?

15 points 5. Suppose you select balls from a bin which contains 4 yellow and 6 green balls.

/3 If you select 4 balls, <u>one at a time</u> (without replacement) what is the probability of selecting a <u>green</u> ball and then a <u>yellow</u> ball and then <u>two</u> green balls?

/4 If you select 4 balls, <u>all at the same time</u> (i.e. not one at a time), what is the probability of selecting three yellow balls and one green ball (and order doesn't matter)?

/4 Now, if you select 2 balls, first one and then the other, but you don't see the color of the first ball, what is the probability that the second ball is <u>yellow</u>? (Show all pertinent work. Don't just guess/give an answer.) **DO simplify this answer.**

```
                                    Yellow
                     Yellow
                                    Green

                                    Yellow
                     Green
                                    Green
```

/4 If you select 2 balls, first one and then the other, if the second ball is yellow, what is the probability that the first ball is green? (Show all pertinent work.) **DO simplify this answer.**

26 points 6. Suppose for a certain group of people, 5% of them have the Flu, and suppose that a certain test which is used to determine whether a person has the Flu gives false negatives 20% of the time and false positives only 10% of the time.
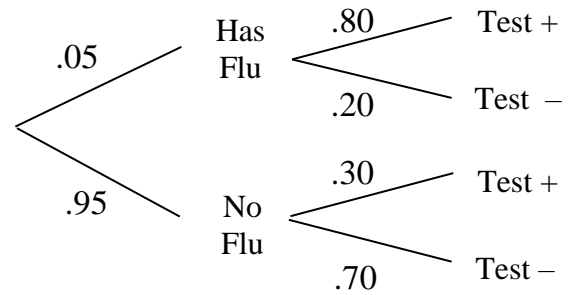
Simplify your answers and fill in the following table.   Be sure to **show all pertinent work below**.

.05 — Has Flu — .80 — Test +

.20 — Test −

.95 — No Flu — .30 — Test +

.70 — Test −

For example, Pr($Flu \,|- Test$)

Results of test

	No Test	Positive	Negative
/8 Pr(Has Flu)	.05		
/8 Pr(Doesn't have Flu)	.95		

/5   What is the probability that a randomly selected person who has tested <u>positive</u> once would test <u>negative</u> if he/she were tested again?

/5   What is the probability that a randomly selected person who tests <u>positive</u> once and <u>negative</u> once actually has the Flu?

8 points   7. Experience shows that younger drivers are more likely to have accidents, and similarly for the very elderly. Consider the information at right for a car insurance company.

Age group	Fraction of all policy holders	Fraction of group in accidents A each year
16 – 24	.20	.10
25 – 64	.60	.03
65 –	.20	.05

/3   What fraction of their policy holders are in a car accident each year. That is, what is $\Pr(A)$, where A is the event of being in an accident?

/5   If a policy holder calls in and says they were in an accident, what is the probability they are part of the 25 – 64 age group?

5 points   8. Consider four boxes. Two of the boxes contain two gold coins each, one box contains a gold coin and one silver coin, and one box contains two silver coins. Suppose that you select a box at random and then select a coin at random from that box. If the coin is gold, what is the probability that the other coin in the box is gold?

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