NAME: ______________________

Philosophy 3300: Philosophy of Medicine (Fall 2025)
Exam 2 - Quiz portion

Questions 1-3 are each worth 1 point, questions 4-6 are each worth 2 points.

Multiple Choice. Circle any correct answers. There may be any number of correct answers.

1) Assume that one type of event *A* is positively correlated with another type of event *B*. Which of the following MUST be true?

a) *A* causes *B*
b) Either *A* causes *B* or *B* causes *A*, but you can't tell which without more information.
c) If the probability of *A* were increased, then the probability of *B* would increase as well.
d) *A* must happen more often than not (more than 50% of the time) whenever *B* happens.
e) *A* happens when *B* happens more often than *A* happens when *B* doesn't.
   YES CORRECT - $P(A|B) > P(A|\sim B)$
f) *B* is also correlated with *A*
   YES CORRECT

2) In testing a drug vs. a placebo, a Relative Risk (RR) of 1.0 would indicate what?

a) The drug works perfectly - it removes all risk (100% of the risk).
b) The drug works better than the placebo.
c) The placebo works better than the drug.
d) They work equally well - there is no difference.
   YES CORRECT (a/a+b = c/c+d when the ratio is 1)
e) There is no way to tell - you need more information about the case.
f) This is actually a typo or a mathematical mistake of some kind. An RR of 1.0 is actually impossible.

3) Imagine a badly designed test for strep throat that produces a positive test result every single time no matter what.

What is the sensitivity of this test?

Sensitivity = P(+|D) = 1 in this case

What is its specificity?

Specificity = P(-|~D) = 0 in this case

4) In a given town some people live very close to a coal plant and others live farther away. A number of people across the town have gotten cancer. Here are some statistics:

Near the plant:

100 men have cancer
100 men do not have cancer
50 women have cancer
50 women do not have cancer
= total of 300 people

Far away from the plant

100 men have cancer
900 men do not have cancer
50 women have cancer
450 women do not have cancer
= total of 1500 people

Questions: (show your work/explain your answer)

4a) Is living near the plant correlated with having cancer?

P(C|NP) = 150/300
P(C|~NP) = P(C|AP) = 150/1500
These are not the same so yes, they are correlated

4b) Is sex correlated with having cancer?

P(C|M) = 200/1200 = 1/6
P(C|W) = 100/600 = 1/6
So no, they are not correlated. They are independent.

5) In a ten-year study testing an experimental drug, we get the following data:

Out of 2000 men aged 60 at the beginning of the study who did not take a drug or a placebo, 200 had a heart attack within the next ten years.

Out of 1000 men who took the placebo, 90 had a heart attack in the next ten years.

Out of 500 men who took the experimental drug, 40 had a heart attack.

Calculate the following: (explain/show your work)

5a) What is the relative risk reduction (RRR) of taking the drug vs. the placebo?

RR = (40/500) / (90/1000) = 80/90 = 8/9
So RRR = 1-8/9 or 1/9 or ~.11

5b) What is the risk difference (RD- or absolute risk reduction) of the drug vs. a placebo?

RD = 40/500 - 90/1000 = 80/1000 - 90/1000 = -10/1000 = -.01

5c) What is the number needed to treat? In other words, what is the expected number of individuals who would have to take the drug instead of the placebo in order to prevent one heart attack?

1/RD = 1/.01 = 100

5d) Out of every thousand men who take the drug, how many heart attacks are prevented when compared to the baseline rate of taking no drug or placebo at all?

No drug - 200/200 heart attacks = 100/1000.
With drug - 40/500 heart attacks = 80/1000.
So 20 heart attacks prevented.

6) You are feeling a bit under the weather. Given your symptoms and past history, you estimate the chances that you have COVID-19 are about 50-50. You want more information so you take a COVID-19 rapid antigen test (a swab up your nose) which can be taken at home with minimal training.

Different studies give slightly different estimates for the reliability of such tests, but imagine that we get the following experimental data (not too far off):

> 1,000 people with COVID-19 took the test and 600 got a positive result.
>
> 1,000 people without COVID-19 took the test and 20 got a positive result.

Now imagine that you take the test and get a positive test result. Use Bayes's Theorem to estimate the probability that you have COVID. Show your work.

P(C|+) = P(+|C) P(C) / [P(+|C) P(C) + P(+|~C) P(~C)] = .6 x .5 / (.6 x .5 + .02 x .5) = .3 / .31 = **30/31** (which is ~97%)

-- What if instead you had gotten a negative result? Now what would the best estimate be for the probability that you really are infected with COVID?

P(C|-) = P(-|C) P(C) / [P(-|C) P(C) + P(-|~C) P(~C)] = .4 x .5 / (.4 x .5 + .98 x .5) = .2 / .2+.49 = .2/.69 = **20/69** (which is ~29%)

NOTE: In other words, you can trust positive results (false positives are very rare). Negative results? Well, some evidence but you still might have it. False negatives are common.