

Name: _____

Directions: The following exam consists of 24 questions, for a total of 100 points with 0 bonus points. Read each question carefully (note: answers may break onto the next page).

*For each question, choose one and only one (the best) answer (unless the question states otherwise). In cases where you are asked to choose all that apply, it is possible that the **all** or **none** of the options are correct. Finally, note that “iff” stands for “if and only if”.*

1 Multiple Choice

1.1 Basic Concepts

- (3 points) What type of argument is one where it is *impossible* for the premises to be true and the conclusion false.
 - deductively valid
 - deductively invalid
 - inductively strong
 - inductively weak
 - inductively valid
- (3 points) What type of argument is one where it is *implausible (unlikely)* for the premises to be true and the conclusion false.
 - deductively valid
 - deductively invalid
 - inductively strong
 - inductively weak
 - inductively valid

1.2 Inductivism

- (3 points) Which one of the following is the best description of the inductivist picture of the method of science?
 - Scientists observe the world. They note that a large number of As have been observed under a wide variety of conditions and all of those As unequivocally have the property B. They thus conclude that all As are Bs (a generalization). From this generalization, they are then able to deduce various predictions.
 - Scientists discover various laws of nature, they then use these laws of nature and hypotheses to make observations of the world. Finally, they make inductions to the best (or most reasonable) explanation.
 - Scientists make hypotheses about the world. These hypotheses take the form of general laws. These laws are used to make predictions. The role of scientists then is to try to falsify these predictions.
 - Scientists observe the world. From these observations they make deductions about the way the world is, how things are, and what hypotheses are worth pursuing.
- (3 points) Which of the following best describes the “problem of induction”?

- A. the problem states that inductive arguments can be justified by deductively valid arguments or experience. Inductive arguments cannot be justified by deduction since inductive arguments are not deductively valid. Inductive arguments cannot be justified by experience since any appeal to experience to justify induction will take the form of an inductive argument.
 - B. the problem states that inductions cannot be justified since it is vague how many observations are enough to constitute a good inductive argument
 - C. the problem states that inductions cannot be justified since it is vague what constitutes a sufficient diversity of observations
 - D. the problem states that inductions cannot be justified since it cannot account for unobservable entities.
5. (3 points) Which of the following is a feature that influences the quality of an inductive argument that reasons from a set of observations to a conclusion? (*Choose all that apply*).
- A. the number of observations
 - B. the diversity of observations
 - C. the consistency of the observations
 - D. the relevance of observations

1.3 Falsificationism

6. (3 points) What kind of argument does the falsificationist make use of to disprove (or falsify) a theory?
- A. a deductively valid argument (specifically modus tollens)
 - B. an inductively strong argument (specifically enumerative induction)
 - C. a probabilistic argument (by employing Bayes theorem)
 - D. an abductive argument
 - E. a retroductive argument
7. (3 points) What does it mean for a hypothesis h to be falsifiable?
- A. a hypothesis h is falsifiable if and only if it is logically possible for there to be some observation that if established would be inconsistent with the truth of h .
 - B. a hypothesis h is falsifiable if and only if someone has already had an observation that is inconsistent with the truth of h .
 - C. a hypothesis h is falsifiable if and only if h is known to be false.
 - D. a hypothesis h is falsifiable if and only if h can be proven false mathematically.
8. (3 points) Which of the following statements are falsifiable?
- A. objects fall at a rate proportional to their mass.
 - B. All bachelors are unmarried men.
 - C. There are 10,000 trees in State College or there are not 10,000 trees in State College.
 - D. All swans are white.
 - E. John is taller than five feet.
 - F. God is all-loving. When there is goodness in the world, this is a sign of God's love. When there is pain or suffering (or something contrary to God's love), then is also a sign of God's love (part of God's greater plan).
9. (3 points) What is an ad hoc modification?

- A. a modification to a theory T is an ad hoc modification if and only if the modification adds to, replaces, or alters a component T but the alteration has no testable consequences that are not already found in T .
 - B. a modification to a theory T is an ad hoc modification if and only if it modifies the theory in any way whatsoever.
 - C. a modification to a theory T is an ad hoc modification if and only if the modification adds to, replaces, or alters a component T but the alteration has adds new testable consequences to T .
 - D. a modification to a theory T is an ad hoc modification if and only if it modifies the theory in a way that makes the theory more easily falsifiable.
10. (3 points) Which of the following examples are not ad hoc modifications to a theory T . Choose all that apply.
- A. In the 19th century, Newtonian physics (T) predicted that Uranus would have a specified orbit. Uranus, however, did not orbit as Newtonian physics predicted. In response, Leverrier and Adams modified Newtonian physics and its current picture of the universe by adding an additional planet that would exert gravitational force on Uranus to explain its strange orbit. Thus, Newtonian physics and the current picture of the solar system was modified by adding an additional planet.
 - B. Consider a theory T that “bread nourishes”. Now suppose we find a batch of bread poisons a group of people. Now suppose a modification to T in the following way “bread nourishes except that particular batch of bread that poisoned people”.
 - C. Consider the theory T that all planets are perfect spheres. Now suppose that looking through a telescope shows that planets are not perfect spheres (e.g. mountains and craters). Now suppose a modification to T in the following ways “planets are perfect spheres that appear to have mountains are craters but these imperfections are actually filled in by an invisible substance”
 - D. Consider a theory T that “bread nourishes”. Now suppose we find a batch of bread poisons a group of people. Now suppose a modification to T in the following way “bread nourishes except bread with a specific fungus”.
11. (3 points) What is the systematic discovery thesis and why is this problematic as an account of how scientific discoveries are made?
- A. science employs a specific and rule-governed method for making discoveries. It is problematic since many discoveries appear to be by chance, e.g. Kekule’s discovery of benzene.
 - B. the context of discovery of many scientific discoveries occur in a specific, highly-structured environment. The problem with this because the contexts for scientific discovery vary from discovery to discovery.
 - C. science employs a chaotic and chance-governed method for making discoveries. This is problematic since scientists actually do make use of a rationale, rule-governed procedure to make discoveries.

1.4 Explanation

12. (3 points) What is the general structure of the covering law model (CLM) of explanation?
- A. The CLM of explanation says that an explanation takes the form of an argument that contains at least one general law and any particular facts (the explanans) as premises, and the phenomena (or event) to be explained (the explanandum) as the conclusion.
 - B. The CLM of explanation says that an explanation takes the form of an argument that predicts a general law of nature (the explanandum) from observable facts that are collectively agreed upon by the community of scientists (the explanans).

- C. The CLM of explanation says that a scientific explanation is one where the phenomena to be explained (the explanandum) is explained by citing what caused that phenomena (the explanans).
13. (3 points) What are the two problems with the covering law model (CLM) of explanation? Choose the two best answers..
- A. irrelevance. The CLM model allows for explanations that meet all of the conditions of the CLM but cite features in the explanans that are irrelevant to the explanandum.
 - B. lack of asymmetry. The CLM model allows for explanations that meet all of the conditions of the CLM but where features of the explanans can be substituted with the explanandum. That is, the object to be explained can be used to explain some part of the explanation.
 - C. invalidity. The CLM model allows for explanations that meet all of the conditions of the CLM but where the argument (explanation) is not valid.
 - D. inductive weakness. The CLM model allows for explanations that meet all of the conditions of the CLM but where the argument (explanation) is not inductively strong.
14. (3 points) What is the primary problem with the causal model of explanation?
- A. the problem with the causal model is that it explains “explanation” through the notion of “causation”. One should not explain some idea A with another B where B is less understand (less clear) than A .
 - B. the problem with the causal model is that causes are irrelevant to the object that is being explained (the explanandum).
 - C. the problem with the causal model is that causes are asymmetrical.
 - D. the problem with the causal model is that causes are relevant to the object that is being explained.

1.5 Bayesianism

15. (3 points) What is Bayes’ theorem? Write out the formula.
16. (3 points) What is Bayes’ theorem supposed to tell us?
- A. the posterior probability of a hypothesis given some evidence e (that is, $P(h/e)$). That is, how to adjust the probability of some hypothesis given some new evidence.
 - B. the prior probability of a hypothesis (that is, $P(h)$). That is, the probability of some hypothesis before we take into consideration any evidence.
 - C. the prior probability of evidence e (that is, $P(e)$). That is, how likeliness of some bit of evidence.
 - D. the posterior probability of evidence e given a hypothesis h (that is, $P(e/h)$). That is, how likeliness of some bit of evidence given the truth h .
17. (3 points) According to the Bayesian, if some observation or piece of evidence e is likely under a variety of hypotheses h_1, h_2, h_3 , then does that e strongly increase the probability of h_1 ?
- A. No, if e is likely whether h is true or not, then e **will not** significantly increase the probability of h . In short, trivial observations don’t strongly support any scientific theory.
 - B. Yes, if e is likely whether h is true or not, then e **will** significantly increase the probability of h . In short, trivial observations do strongly support any scientific theory.
 - C. Yes, if e is likely whether h is true or not, then e **will** significantly increase the probability of h . In short, any evidence that supports a theory will make influence the probability of a hypothesis in a way that makes it more probable than its rivals.

18. (3 points) According to the Bayesian, what does it mean to say that a hypothesis has been “confirmed”?
- A hypothesis h is confirmed iff $P(h/e) > P(h)$.
 - A hypothesis h is confirmed iff it is not in conflict with other theories. That is, $P(h_1)$ is confirmed if and only if it is possible for both $P(h_1)$ and $P(h_2)$ to be true.
 - A hypothesis h is confirmed iff $P(h)$ is more probable than any other hypothesis. That is, h_1 is confirmed iff $P(h_1)$ is greater than the probability of any other hypothesis.
 - A hypothesis h is confirmed iff $P(e) > P(h)$.
 - A hypothesis h is confirmed iff $P(h) = P(h)$.
19. (3 points) How does the Bayesian address the problem of ad hoc modifications to hypotheses? Indicate all that apply.
- Assuming some ad hoc modification a , if a hypothesis h involves an ad hoc modification, then the probability of the hypothesis and the ad hoc modification being true is always less than the probability of the hypothesis being true by itself (viz., $P(h\&a) < P(h)$).
 - Many ad hoc modifications are highly implausible so the addition of them to a hypothesis only makes the hypothesis more improbable (e.g. hypothesis that a unicorn exists and the ad hoc modification to that they are invisible).
 - ad hoc modifications are not acceptable because they make a theory less falsifiable.
 - ad hoc modifications increase the probability of a hypothesis and therefore make the probability of the hypothesis being true more likely.
20. (3 points) How does the Bayesian respond to the objection that probability should not rest on subjective conditions. In particular, how do Bayesianists deal with the charge that science should not initially rest on how different people assign different probabilities to hypotheses?
- The initial differences concerning the assignment of probabilities to hypotheses $P(h_1), P(h_2), P(h_3)$ is unproblematic since continued use of Bayes theorem with incoming evidence will yield a convergence concerning the posterior probability $P(h/e)$.
 - The initial differences concerning the assignment of probabilities to hypotheses $P(h_1), P(h_2), P(h_3)$ is unproblematic since all prior probabilities are, in fact, objectively determined.
 - The initial differences concerning the assignment of probabilities to hypotheses $P(h_1), P(h_2), P(h_3)$ is unproblematic since the probabilities of hypotheses start out as equal probability (so there really is no subjective features to probability).
 - initial differences concerning the assignment of probabilities to hypotheses $P(h_1), P(h_2), P(h_3)$ is unproblematic since scientists use Bayes’ theorem to determine the prior probability of h , viz., $P(h)$.

2 Short Answer

21. (10 points) The naive empiricist view says that all of our knowledge is based on experience, observation, or information. This experience is said to have four key features. List three of the four features.
22. (10 points) Explain the Duhem-Quine objection. In explaining this objection, be sure to (i) indicate what theory of science this objection applies to, (ii) the key features of the objection, and (iii) provide one illustration (example) of this objection.
23. (10 points) Explain the Sophisticated Falsificationist Model of Science. That is, explain what sophisticated falsificationism is by stating each component of the theory.
24. (10 points) What is the Bayesian approach to the philosophy of science (Bayesianism)? In explaining this approach, cite one of the three key points discussed in class as to why this approach adequately explains scientific activity.