

Name: _____

Student ID: _____

Problem 1

(15 pts) Draw a truth table and use it to identify whether the following argument is valid: $a \vee (b \& c), a \vee \sim b$, therefore $\sim(b \& \sim c)$.

Problem 2

(15 pts) [The actual final will ask one of the questions from the following list, and you will have to write a few sentences answering it.]

List of possible questions:

- Why does Hume think we can never have a deductive proof of the uniformity of nature?
- Why does Hume think an inductive argument for the uniformity of nature can never be convincing?
- What does it mean for an argument to be inductively strong, and how is this related to epistemic probability?
- What does it mean for an argument to be deductively valid, and how can truth tables be used to identify it?

Problem 3

For these questions, either calculate the desired probability, or state that not enough information is present.

- (a) (5 pts) If $Pr(a \& b) = .2$ and $Pr(a) = .5$, then what is $Pr(a \& \sim b)$? _____
- (b) (5 pts) If $Pr(c) = .6$ and $Pr(c \vee d) = .8$, then what is $Pr(c \& \sim d)$? _____
- (c) (5 pts) If $Pr(e \vee \sim f) = .7$ and $Pr(e) = .3$, then what is $Pr(f)$? _____
- (d) (5 pts) If $Pr(g) = .4$ and $Pr(\sim g \vee h) = .8$, then what is $Pr(g \& h)$? _____
- (e) (5 pts) If $Pr(j) = .5$ and $Pr(k) = .4$ and $Pr(j \& k) = .1$, then what is $Pr(j \vee k)$? _____
- (5 pts) Are j and k probabilistically independent? _____
- (f) (5 pts) If $Pr(m) = .3$ and $Pr(m \vee n) = .6$ and $Pr(m \& n) = .1$, then what is $Pr(n)$? _____
- (5 pts) Are m and n probabilistically independent? _____
- (g) (5 pts) If $Pr(p) = .75$ and $Pr(r) = .5$ and $Pr(p \& \sim r) = .5$, then what is $Pr(p \& r)$? _____
- (5 pts) Are p and r probabilistically independent? _____

Problem 4

Fill in the probabilities of this truth table (5 pts each) using the following information:

- $Pr(a) = .5$
- $Pr(b \mid a) = 3/5$
- $Pr(b \mid \sim a) = 1/5$
- $Pr(c \mid (a \& b)) = 1/2$
- $Pr(c \mid (a \& \sim b)) = 3/4$
- $Pr(c \mid (\sim a \& b)) = 0$
- $Pr(c \mid (\sim a \& \sim b)) = 1/4$

a	b	c	Pr
T	T	T	_____
T	T	F	_____
T	F	T	_____
T	F	F	_____
F	T	T	_____
F	T	F	_____
F	F	T	_____
F	F	F	_____

Problem 5

A spinner divided into 8 equal sections numbered 1 through 8 is spun. The pointer is equally likely to end up in any of these sections. Calculate the expected value of each of these gambles:

- (a) (5 pts) +8 if the result is 3 or less, nothing otherwise. _____
- (b) (5 pts) +16 if the result is exactly 5, −8 if the result is exactly 8, nothing otherwise. _____
- (c) (5 pts) +4 if the result is odd, −4 if the result is even. _____
- (d) (5 pts) +10 if the result is 4 or 8, −2 if the result is odd, nothing otherwise. _____

Problem 6

- (a) (10 pts) Alex is deciding whether to bike to work (+8 if it doesn't rain, −8 if it rains) or take the bus (+4 regardless of weather). Alex checks the forecast, which says there's a chance of rain, and decides to take the bus. How likely must Alex think it is to rain for this decision to be rational?
- (b) (10 pts) Priya is deciding whether to head home during her lunch break to make avocado toast or to buy lunch at the cafeteria. Making avocado toast gives her +12 utility if the avocado is ripe, but an unknown negative utility if the avocado is overripe and brown inside. Buying lunch at the cafeteria gives her +4 utility for sure. If Priya thinks there's a 50% chance the avocado is ripe, but still chooses to buy lunch at the cafeteria, how bad must her utility be for making toast with a brown, overripe avocado?

Problem 7

A journalist is investigating whether a politician accepted a bribe (b). Currently, she assigns $Pr(b) = .3$. The journalist decides to interview some sources at city hall. She might find a witness who observed the meeting (w) — there is a decent chance of finding such a witness if the bribe occurred ($Pr(w \mid b) = 2/5$) but also a small chance of finding someone who incorrectly claims to have seen a meeting ($Pr(w \mid \sim b) = 1/10$). The journalist might also find financial records showing an unexpected payment (f ; $Pr(f \mid b) = 3/4$), although there could be other explanations for such records ($Pr(f \mid \sim b) = 1/4$).

- (a) (10 pts) What is $Pr(b \mid w)$? _____
- (b) (10 pts) What is $Pr(b \mid f)$? _____
- (c) (20 pts) If w and f are independent conditional on b and on $\sim b$, then what is $Pr(b \mid w \& f)$? _____