

MAT1374 Probability and Games of Chance: Poker101
Supplemental Examination, July 2015
Instructor: Pieter Hofstra

LAST NAME:	
First name:	
Student ID:	

INSTRUCTIONS:

1. This exam consists of two parts: one set of multiple choice questions and one set of long answer questions. You should complete **50** of the first set of multiple choice questions and **3** long answer questions. If you answer more questions than you need to only the first 50 will be graded.
2. The exam is closed book. Notes are not allowed. You may use a calculator. Please make sure that all other electronic devices such as cellphones are switched off.
3. **Write your answers to the multiple choice questions in the boxes on this page.**
4. Write your answers to the long answer questions in the space provided under the questions. Don't use red ink. Unreadable or ambiguous answers are counted as incorrect.
5. If you have a chips surplus, you can use this to buy multiple choice questions. Each question costs 5 chips. If you wish to buy a question, write X in the answer box. You can't buy long answer questions. If you purchase a question but cannot afford it, it will be marked wrong.
6. There are two bonus questions as the end of the Multiple Choice section.

Multiple Choice Answers: answer 50 out of 70 questions!

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70

Multiple Choice Questions

Complete 60 of the following multiple choice questions. Write your answers in the box on the cover page. Each question is worth one point. If you wish to use your chips to buy a certain question, write X as your answer to that question. One question costs 5 chips.

1. Which of the following best describes the difference between sequential games and simultaneous games?
 - (A) In sequential games players have many strategies, while in simultaneous games there are only two strategies available.
 - (B) In sequential games players take turns making moves, while in simultaneous games players make their move without knowing what the others will do.
 - (C) Sequential games are more complicated to analyse.
 - (D) Sequential games involve two players, while simultaneous games involve many players.
2. Which of the following is a good example of a simultaneous game?
 - (A) Tic-tac-toe
 - (B) Rock-Paper-Scissors
 - (C) Chess
 - (D) Poker
3. Which of the following components determine a game?
 - (A) Players, Strategies, Moves, Intelligence.
 - (B) Players, Strategies, Information, Moves.
 - (C) Players, Information, Moves, Payoffs
 - (D) Players, Rules, Information, Moves.
4. Consider the game tree in Figure 1. (Payoffs for Player 1 are listed first.) What is the rollback equilibrium in this game?
 - (A) (a,k,d)
 - (B) (a,l)
 - (C) (b,k,u)
 - (D) (b,l)
 - (E) (c,k,d)
 - (F) (c,l)
5. In the game of the previous question, how many strategies does Player 1 have?
 - (A) 6
 - (B) 11
 - (C) 18
 - (D) 54
 - (E) None of the above

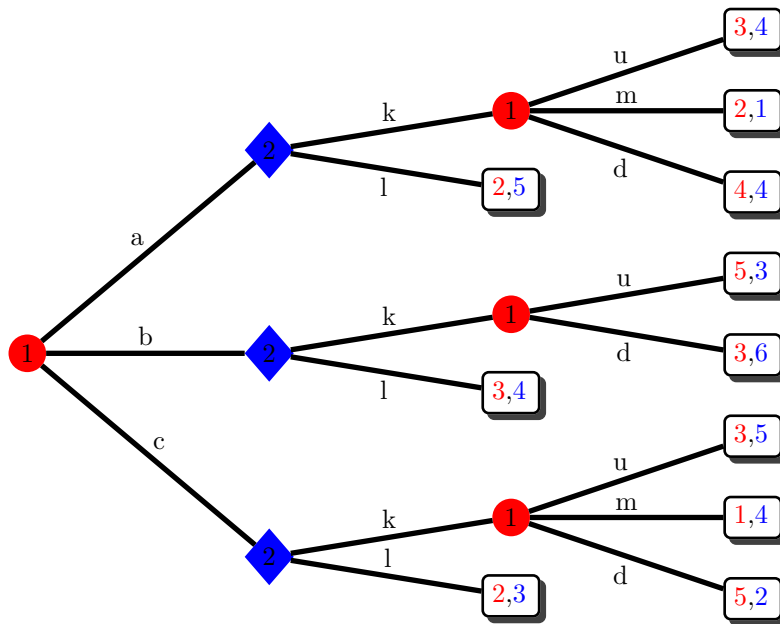


Figure 1: Game tree No. 1

6. Consider the misere variant of 21 flag where you take 1,2,3 or 4 flags each turn, and where the player who takes the last flag loses. Suppose there are 18 flags left and it is your turn. What is the winning move?
 - (A) Take 1 flag.
 - (B) Take 2 flags.
 - (C) Take 3 flags.
 - (D) Take 4 flags
 - (E) Doesn't matter, this is a lost position.

7. Which of the following statements about Nash Equilibria in simultaneous games is correct?
 - (A) In a Nash Equilibrium all players always play a dominant strategy.
 - (B) In a Nash Equilibrium each player plays his/her best response to the other players move.
 - (C) In a Nash Equilibrium at least one of the players can improve his/her payoffs by changing strategies, but only when the other players don't change their strategies.
 - (D) In a Nash Equilibrium all players necessarily play a mixed strategy.

8. Consider the following 2x2 game matrix:

		Player 2	
		/	\
Player 1	3	10	1
	1	1	3
	1	10	3

What kind of game is this?

- (A) Chicken
- (B) Pure Coordination
- (C) Battle of the Sexes
- (D) Prisoner's Dilemma

9. Consider the following 2x2 game matrix:

		Player 2	
		a	b
Player 1	a	3 3	2 0
	b	0 2	3 1

Which of the following is true?

- (A) Neither player has a dominant strategy.
 - (B) Player 1 has a dominant strategy, player 2 doesn't.
 - (C) Player 2 has a dominant strategy, player 1 doesn't.
 - (D) Both players have a dominant strategy.
10. Consider again the 2x2 game matrix from the previous question. Which of the following is true?
- (A) There are no Nash Equilibria in pure strategies.
 - (B) There is one Nash Equilibrium, namely (a,a).
 - (C) There is one Nash Equilibrium, namely (b,b).
 - (D) There are two Nash Equilibria, namely (a,a) and (b,b).
11. Which of the following statements about dominant strategies is correct?
- (A) A dominant strategy gives a higher payoff than a dominated strategy, but only if your opponents also play dominant strategies.
 - (B) A dominant strategy is only useful when your opponents are irrational.
 - (C) A dominant strategy is only useful when your opponents are rational.
 - (D) A dominant strategy always gives a higher payoff than other strategies, regardless of what your opponents do.
12. Is it possible for a 2x2 game to have no Nash Equilibria in pure strategies?
- (A) No.
 - (B) Yes, the Chicken game is an example.
 - (C) Yes, the Prisoner's Dilemma is an example.
 - (D) Yes, Matching Pennies is an example.
13. What is the main difference between a pure coordination game and the battle of the sexes game?
- (A) In the battle of the sexes game, players should aim to play the opposite of what their opponent does, while in the coordination game they should try to play the same.
 - (B) The pure coordination game has two Nash equilibria in pure strategies, while the battle of the sexes has none.
 - (C) The pure coordination game has no Nash equilibria in pure strategies, while the battle of the sexes has two.
 - (D) In the battle of the sexes game, players are not indifferent between the Nash equilibria.

14. Suppose in a 2x2 game, we're trying to find the optimal mixed strategy for player 1. Which statement is correct?
- (A) The correct mix for player 1 only depends on the payoffs for player 1.
 - (B) The correct mix for player 1 only depends on the payoffs for player 2.
 - (C) The correct mix for player 1 depends on the payoffs for both players.
 - (D) None of the above.
15. Why is $[1/3R, 1/3P, 1/3S]$ part of a mixed strategy equilibrium in Rock-Paper-Scissors?
- (A) It yields the highest expected payoff regardless of what your opponent does.
 - (B) Your opponent cannot improve his payoffs by choosing a suitable pure strategy.
 - (C) It maximizes the chances of your opponent getting confused.
 - (D) It takes maximal advantage of possible mistakes your opponent may be making.
16. In the game below, is (b,r) an equilibrium?

		Player 2			
		p	q	r	s
Player 1	a	3 1	2 1	4 0	2 1
	b	0 2	1 1	2 2	1 3
	c	1 1	1 3	2 1	1 2

- (A) Yes, it is.
 - (B) No, because Player 1 would get a higher payoff at (b,s).
 - (C) No, because Player 2 would get a higher payoff at (a,r).
 - (D) No, because in that scenario neither player has minimized the other player's payoffs.
17. Which of the following statements about EV (expected value) for the player in blackjack is correct?
- (A) On average the EV is positive, but occasionally the composition of the remaining shoe of cards may result in a negative EV.
 - (B) On average the EV is negative, but occasionally the composition of the remaining shoe of cards may result in a positive EV.
 - (C) On average the EV is negative, but after a reshuffle of the deck the EV may be positive for a brief period of time.
 - (D) On average the EV is positive, but after a reshuffle of the deck the EV may be negative for a brief period of time.
18. Suppose in blackjack, the remainder of the deck is rich in tens. How does this affect your play in the following situation? You have a total of 16, the dealer shows an 8.
- (A) According to basic strategy you should hit, but when the deck is rich in tens you should double.
 - (B) According to basic strategy you should stand, but when the deck is rich in tens you should hit.

- (C) According to basic strategy you should stand, but when the deck is rich in tens you should double.
 - (D) According to basic strategy you should hit, but when the deck is rich in tens you should stand.
19. In card counting, a player tries to take advantage of situations where the remainder of the deck is favourable (rich in tens). How should the player do this?
- (A) By increasing the bet amounts and diverging from basic strategy in appropriate situations.
 - (B) By being more aggressive in marginal situations.
 - (C) By decreasing the betting amounts and diverging from basic strategy in appropriate situations.
 - (D) By introducing mixed strategies in order to keep the casino from discovering your intentions.
20. The Public Investment game, as played in class, can be described as a multi-person prisoner's dilemma. Why?
- (A) In both games, it is impossible to predict what the others will do, and hence in both games undesirable outcomes are inevitable.
 - (B) Both games involve trying to minimize your opponents' payoffs.
 - (C) Everyone has a dominant strategy, but when everyone plays that strategy the overall outcome is not desirable.
 - (D) In both games, there are strategies which seem reasonable but which turn out to be risky due to the unpredictability of your opponents.
21. In the "Countries and Troops" game, as played in class, what can we say about equilibria?
- (A) Each player has a dominant strategy, and thus there is exactly one equilibrium.
 - (B) There are no equilibria in pure strategies.
 - (C) There are no dominant strategies, but there is one equilibrium in pure strategies.
 - (D) There are several equilibria in pure strategies.
22. Suppose you're playing a game in which you have chosen a particular strategy. What do we mean when we say that this strategy is exploitable?
- (A) It means that the opponent can minimize your payoffs by choosing a suitable pure strategy.
 - (B) It means that the opponent can implement a strategy which will result in at best a payoff of 0 for you.
 - (C) It means that the strategy is dominated by other strategies which you should have chosen instead.
 - (D) It means that the opponent can take advantage and maximize his payoffs by choosing a suitable pure strategy.
23. Which of the following behaviours is not rational, in the game-theoretic sense?
- (A) Playing a game of pure chance.
 - (B) Accepting a bet in which the chances of losing are higher than the chances of winning.
 - (C) Playing poker against an opponent who is more intelligent than yourself.
 - (D) Playing a dominated strategy in a simultaneous game.
24. What was John von Neumann's role in the development of game theory?
- (A) His 1928 article on the theory of parlor games laid out the mathematical foundations of game theory.

- (B) He proved that all games have Nash Equilibria.
 - (C) He added a new dimension to the theory of games by introducing strategic moves.
 - (D) His 1944 book with Oskar Morgenstern *Theory of Games and Economic Behavior* was the first text to consider the competitive nature of the free market.
25. For which contribution to game theory did John Nash receive the Nobel Prize?
- (A) For disproving von Neumann's Minimax Theorem.
 - (B) For his solution concept for simultaneous games.
 - (C) For the invention of mixed strategies.
 - (D) For his study of the role of rationality in game theory.
26. Why did the years immediately following World War II see a booming development of game theory?
- (A) Game theory was increasingly useful for studying problems in economics, and after the war the US economy was in bad shape and needed a boost.
 - (B) Game theory was regarded as a tool for analyzing strategic conflicts and military decisions, and after the war military leaders pushed for more research in these areas.
 - (C) Game theory had played a crucial role in defeating the German forces, and was therefore considered an indispensable tool for high-ranking military officers.
27. Thomas Schelling performed an experiment in which he had pairs of strangers try to meet each other somewhere in New York City. What was the purpose of this experiment and what can be concluded from the results?
- (A) The purpose was to find out how adept people are at navigating maps. The conclusion was that most people are good at it.
 - (B) The purpose was to find out whether extrasensory perception plays a role in complex search tasks. The conclusion was that it didn't.
 - (C) The purpose was to find out whether people can do better than guessing randomly by using focal points. The conclusion was that people rely heavily on such focal points.
 - (D) The purpose was to find out whether people use game-theoretically optimal strategies in complex search tasks. The conclusion was that most people fall short of complete rationality.
28. What do the so-called *paradoxes in rationality* refer to?
- (A) To the fact that people often violate the rules for decision-making as prescribed by Expected Utility Theory.
 - (B) To the fact that many people have a strong desire to make rational decisions but can't seem to succeed in doing so.
 - (C) To the fact that even though many people follow the principles of Expected Utility Theory, they still fail to maximize their utility.
 - (D) To the fact that people are typically not interested in monetary gain or loss, but take other things into account when evaluating different possible outcomes of their decisions.
29. Various experiments have been conducted involving the Ultimatum Game. What general statement best sums up the conclusion we may draw from such experiments?
- (A) The vast majority of subjects is not capable of figuring out the optimal strategy for this game quickly enough to play well.
 - (B) Some subjects are not able to determine the optimal strategy, but those who do usually play optimally.

- (C) Most subjects knowingly diverge from optimal strategy because they do not expect their opponent to be knowledgeable.
- (D) Most subjects knowingly diverge from optimal strategy because of factors such as fear of rejection, and various social norms and conventions.
30. Which of the following is a difference between a threat and a promise?
- (A) Threats are deterrent, while promises are compellent.
- (B) When successful, threats are costless, but successful promises are not.
- (C) Threats are unconditional, but promises are conditional.
- (D) Threats involve taking a course of action which is suboptimal, while promises involve the best course of action.
31. In what sense does an engagement ring function as a screening test?
- (A) It forces the man to reveal whether he is serious about marriage.
- (B) It forces the man to reveal his financial status.
- (C) It forces the man to reveal his taste in jewelry.
- (D) It forces the woman to reveal how materialistic she really is.
32. Which of the following best describes what Cardano's Law is about?
- (A) It indicates how to predict future behaviour of a random process from past observations.
- (B) It explains why certain processes such as throwing a die are inherently unpredictable.
- (C) It tells how to determine the likelihood that the outcome of a random process such as throwing a die is favourable.
- (D) It is a tool for determining whether a process such as flipping a coin is biased or genuinely random.
33. Suppose we draw a card from a standard shuffled deck of cards. What is the probability that we draw a red Broadway card? (Tens, Jacks, Queens, Kings and Aces are Broadway cards.)
- (A) $5/52$
- (B) $10/52$
- (C) $13/52$
- (D) $20/52$
- (E) None of the above.
34. We draw two cards from a standard shuffled deck. What is the chance that we get a pair of Queens?
- (A) $6/1326$
- (B) $1/13$
- (C) $4/1236$
- (D) $16/1326$
35. Which of the following best describes the intended meaning of the conditional probability $P(T|E)$ (where T is a theory and E is experimental data)?
- (A) The probability that the theory is true given the data.
- (B) The probability that the data supports the theory.
- (C) The probability that the data is in conflict with the theory.
- (D) The probability that the the theory will be in agreement with the data.

36. A medical test for a certain disease has no false positives. What does this mean in terms of conditional probability?
- (A) $P(\text{test positive}|\text{disease})=1$
 - (B) $P(\text{test negative}|\text{no disease})=1$
 - (C) $P(\text{test positive}|\text{no disease})=1$
 - (D) $P(\text{disease}|\text{test positive})=1$
37. What is the main function of Bayes' Rule?
- (A) It tells us how to revise probability estimates in the light of new information.
 - (B) It tells us whether new information is likely to be biased.
 - (C) It allows us to determine whether new information is consistent with a given theory.
 - (D) It allows us to determine whether new information is reliable, given our background assumptions.
38. What mistake involving conditional probability is often made by conspiracy theorists?
- (A) Ignoring base rates.
 - (B) Confusing $P(\text{conspiracy true}|\text{evidence})$ with $P(\text{evidence}|\text{conspiracy true})$.
 - (C) Confusing $P(\text{conspiracy true})$ with $P(\text{conspiracy true}|\text{evidence})$.
 - (D) Confusing $P(\text{evidence})$ with $P(\text{evidence}|\text{conspiracy true})$.
39. What is the *Prosecutor's Fallacy*?
- (A) Ignoring base rates.
 - (B) Confusing $P(\text{innocence}|\text{evidence})$ with $P(\text{evidence}|\text{innocence})$.
 - (C) Confusing $P(\text{evidence})$ with $P(\text{innocence}|\text{evidence})$.
 - (D) Confusing $P(\text{innocence})$ with $P(\text{innocence}|\text{evidence})$.
40. After winning a chess tournament you test positive for use of clenbuterol, a banned substance. It is quite rare for a chess player to use clenbuterol; according to statistics only one in a million chess players use this. The test used by the officials is said to be 99% reliable and doesn't produce false negatives. The tournament director disqualifies you. How confident can he be that this decision is correct?
- (A) about 99%
 - (B) about 1%
 - (C) about 99.99%
 - (D) about 0.01%
41. What is the expected value of the following bet? We roll two dice. If the sum is 6 or more, I pay you \$18. Otherwise you pay me \$18.
- (A) \$0
 - (B) \$8
 - (C) \$16
 - (D) \$18
 - (E) None of the above
42. Omaha. You are holding $9\clubsuit T\heartsuit J\clubsuit Q\heartsuit$, and your opponent has $K\heartsuit K\spadesuit 6\heartsuit 6\spadesuit$. The board on the turn is $2\clubsuit 3\spadesuit 8\clubsuit 7\heartsuit$. What is the probability that the river card gives you the winning hand?

- (A) 12/40
 - (B) 14/40
 - (C) 15/40
 - (D) 17/40
 - (E) None of the above.
43. Omaha 8-or-better. You are holding $A♥2♥3♦3♣$, and your opponent has $2♣3♥4♥5♠$. The board on the river is $K♣2♣3♠8♠7♥$. What part of the pot do you win?
- (A) You win high, your opponent wins low.
 - (B) You win both high and low.
 - (C) You win high, nobody wins low.
 - (D) Your opponents wins both high and low.
44. What is the relationship between heuristics on the one hand and biases on the other?
- (A) If judgment is too biased to be accurate, then we have to resort to heuristics.
 - (B) Biases result from incorrect calculations, and heuristics compensate for those.
 - (C) Biases result from the use of heuristics in situations where these don't work optimally.
 - (D) Heuristics are shortcuts used by psychologists in order to explain subjects who display a bias towards gambling.
45. Why does the anchoring heuristic often lead to inaccurate judgment?
- (A) The anchor value may be obviously incorrect, leading to an exaggerated adjustment from that value.
 - (B) People often do not adjust enough from the anchor value.
 - (C) If the anchor value is correct, people will still adjust, leading to an incorrect judgment.
 - (D) The presence of an anchor value tends to slow down people's analysis.
46. What is the *certainty effect*?
- (A) It is the (irrational) phenomenon that people are often bad at making decisions in situations of uncertainty.
 - (B) It is the phenomenon that people are often prepared to pay money to reduce or remove certain risks.
 - (C) It is the phenomenon that people who are faced with uncertainty tend to make irrational decisions.
 - (D) It is the (irrational) phenomenon that people are willing to sacrifice utility in order to completely eliminate certain risks.
47. What does Vickrey's *Revenue equivalence theorem* say?
- (A) All rational bidders in any given auction type will make the same profit.
 - (B) Over the long run, all auction houses generate the same amount of revenue.
 - (C) Assuming rational bidders, all auction types yield the same revenue for the seller.
 - (D) All auction types are on average equally profitable due to the fact that there are always irrational bidders.
48. In what type of auctions is the Winner's Curse most likely to strike?
- (A) Private value auctions with very few bidders.

- (B) Private value auctions with many bidders.
 - (C) Common value auctions with very few bidders.
 - (D) Common value auctions with many bidders.
49. The Kelly criterion is only relevant in betting situations where one condition is satisfied. Which one?
- (A) The bet must be even money.
 - (B) The bet is repeated a large number of times.
 - (C) The chances of winning the bet must be greater than 50%.
 - (D) The available bankroll must be small compared to the money wagered.
50. What is an astralagus?
- (A) An early version of the die, made out of the heelbone of animals.
 - (B) An old board game involving several dice.
 - (C) A machine used for predicting the movement of the stars.
 - (D) A primitive type of playing card.
51. What was the main reason for the foundation of the RAND corporation?
- (A) To provide an attractive academic climate for scientists who would otherwise likely move to Europe.
 - (B) To encourage scientific research which would be beneficial to policy makers and military leaders.
 - (C) To educate the general public about strategic issues.
 - (D) To support scientists who refused to support war-related research.
52. Suppose your bankroll is \$6,000. I offer you an even money bet: you win if the die comes 1,2,3 or 4, and I win if it comes 5 or 6. The die is fair. According to the Kelly criterion, how much should you bet?
- (A) \$2,000
 - (B) \$3,000
 - (C) \$4,000
 - (D) None of the above.
53. Roulette (European). Suppose I bet \$50 on black and \$10 on 0. What is the expectation of this bet?
- (A) $-\$ \frac{10}{37}$
 - (B) $-\$ \frac{19}{37}$
 - (C) $-\$ \frac{20}{37}$
 - (D) $-\$ \frac{60}{37}$
 - (E) None of the above.
54. After 1960, popularity of game theory declined. Why?
- (A) Game theory had not succeeded in contributing significantly to the important problems of the time, and was regarded as an overly abstract, cynical and inhumane viewpoint.
 - (B) Most problems game theorist had set out to solve had been solved by the time, and there were not enough new challenges to justify the large number of scientists working in the area.

- (C) The original motivations for studying game theory, such as understanding parlor games, had largely disappeared.
- (D) Many important game theorists had left academia and started working for various other organizations such as RAND, and as a consequence they were not in a position to continue theoretical research.
55. Suppose in a poker game that you have a weak hand that can only beat a bluff. There is \$100 in the pot, and your opponent bets her last \$50. How likely should your opponent's bet be a bluff for a call to be profitable?
- (A) At least $1/5$ of the time
- (B) At least $1/4$ of the time
- (C) At least $1/3$ of the time
- (D) At least $1/2$ of the time
56. What is the psycho-analytic viewpoint on gambling?
- (A) Gambling is a disorder caused by negative stimuli from the environment.
- (B) Gambling is usually harmless, but excessive gambling is a disorder caused by stress and negative emotions.
- (C) Gambling is a manifestation of deeply seated personality problems which are almost always caused by childhood trauma.
- (D) Gambling is a form of role playing in which people get to act out a character which they cannot be in real life.
57. How, according to behaviourists, does operant conditioning play a role in explaining persistent gambling?
- (A) Gambling, like any addiction, is an involuntary response to the various stimuli associated with the act of gambling.
- (B) Gambling is a learned behaviour which is the consequence of rewards which we received at some point during our gambling activities.
- (C) Gamblers tend to fall victim to irrational thought patterns.
- (D) Gamblers often lack the cognitive abilities to fully analyse the consequences of their behaviour.
58. What is the St. Petersburg Paradox meant to show?
- (A) That games with infinite payoffs are practically impossible.
- (B) That expected utility cannot be equated with expected monetary payoff.
- (C) That certain bets can be deceptive and counterintuitive.
- (D) That bets involving high payoffs and small chances of winning are usually considered less attractive by subjects.
59. In the Sally Clark case, experts testified that the probability of two cases of SIDS (sudden infant death syndrome) occurring within one family was less than one in a million. Therefore, the prosecution argued, it was established within reasonable doubt that the two children were killed. What is wrong with this reasoning?
- (A) It confuses the conditional probability $P(2 \text{ dead children} | \text{guilty})$ with the probability $P(\text{guilty})$.
- (B) It confuses the probability $P(2 \text{ cases of SIDS} | 2 \text{ dead children})$ with the probability $P(2 \text{ dead children} | 2 \text{ cases of SIDS})$.
- (C) It confuses the probability $P(\text{innocent} | 2 \text{ cases of SIDS})$ with the probability $P(2 \text{ cases of SIDS})$.

- (D) It confuses the probability $P(2 \text{ cases of SIDS} | 2 \text{ dead children})$ with the probability $P(\text{innocent})$.
60. Why is a doomsday device a credible deterrent?
- (A) The consequences of triggering it are severe.
 - (B) There is no way of backing out and switching it off.
 - (C) The threat is proportionate for the purpose.
 - (D) The device is relatively cheap and hence it is plausible that the opponent has one.
61. Which of the following 5-card poker hands is the best low hand?
- (A) AAAA2
 - (B) A2358
 - (C) A3567
 - (D) 23456
62. In a sealed-bid private value Vickrey auction, what is your optimal bidding strategy?
- (A) You bet slightly more than what you believe the second highest bid will be.
 - (B) You bid exactly what you think the item is worth.
 - (C) You bid slightly less than what you think the item is worth.
 - (D) There is no optimal strategy in this auction type.
63. What is the probability of getting dealt Ace-King before the flop in Hold'em?
- (A) $1/1326$
 - (B) $4/1326$
 - (C) $12/1326$
 - (D) $16/1326$
64. In the AKQ-game, it was seen that betting a K is never a good idea. Which explains best why this is so?
- (A) There's a 50% chance that you lose to an A.
 - (B) If you bet a K then you can't effectively bluff a Q any more.
 - (C) If you bet a K then your opponent will exploit that by always folding to a bet.
 - (D) If you bet a K then you can never get called by a worse hand.
65. In class, we saw that in the AKQ game, player 2 should occasionally call with a K to prevent player 1 from always bluffing with a Q. Which criterion governs the precise calling frequency?
- (A) Player 2 should call with a frequency which maximizes the probability that (s)he wins the pot.
 - (B) Player 2 should call with a frequency which makes the player 1's EV of a bluff with a Q equal to that of a check with a Q.
 - (C) Player 2 should call with a frequency which makes player 1's EV of a bluff with a Q negative.
 - (D) Player 2 should call with a frequency which minimizes player 1's EV of a bluff with a Q.
66. Bluffing is an important aspect of poker. From a game-theoretic point of view, what is the main reason for bluffing?
- (A) To steal pots when your opponent has a weak hand or is timid.
 - (B) To force your opponent to occasionally pay you off when you have a strong hand.

- (C) To maximize the number of pots you win.
 (D) Bluffing is a strategic move which has the purpose of installing fear in your opponents.
67. Suppose $P(T)=0.3$, $P(E|T)=0.6$ and $P(E|\text{not } T)=0.2$. What is $P(T|E)$?
- (A) 0.5625
 (B) 0.14
 (C) 0.32
 (D) 0.18
68. An important concept in cognitive-behavioural theories about gambling behaviour is that of illusion of control. Which of the following is a good illustration of that concept?
- (A) Claiming that when you sit in a certain seat, you will do better at roulette.
 (B) Using martingale betting systems to beat roulette using mathematics.
 (C) Thinking that you would do better than average at roulette when you would be allowed to spin the ball yourself.
 (D) Thinking that when you won several times in a row, you are now less likely to win.
69. Why can it be difficult for a rational player to make threats and promises credible?
- (A) Rational players always play an optimal move which is part of a Nash Equilibrium; therefore they have no need for threats or promises.
 (B) Rational players don't make threats or promises; rather, they give out warnings and assurances.
 (C) Rational players will only make threats when they know they have no other way of winning; therefore it can be deduced that when a rational player makes a threat, it's because they would otherwise lose.
 (D) Such moves, by definition, involve taking a suboptimal course of action, which rational players cannot be expected to do.
70. What is the difference between signalling and screening?
- (A) Signalling involves transmitting information to another player, while screening is an attempt to extract information from another player.
 (B) Signalling is a method for conveying threats, while screening is a method to avoid getting threatened.
 (C) Signalling involves open communication between the various players, while screening involves transferring of hidden messages.
 (D) Signalling is a method for extracting information by gauging your opponents reaction to various signals, while screening is a method to prevent that from being used against you.

Bonus Problem 1: Complete the following sentence (one word):

The dude

Bonus Problem 2: In Holland, what can you expect to be served when you order “Friet Oorlog” (“War Fries”)?

- (a) Fries with mayonnaise and peanut sauce
 (b) Fries with gravy and malt vinegar
 (c) Fries with beef stew
 (d) Fries with mayonnaise, ketchup and raw onions

Long Answer Questions

Choose 3 out of 5 questions. Write your answers in the space below the questions (you may use the back of the page if necessary). Each question is worth 10 points. You get points for clear, well-structured and relevant motivation of your answers.

Question 1. Consider the following 2x2 game:

		Player 2	
		a	b
Player 1	a	-2 2	3 -2
	b	3 1	1 2

- State the precise definition of Nash Equilibrium.
- Does this game have any Nash Equilibria in pure strategies? If yes, give them. If no, explain why not.
- Find the optimal mixed strategy for both players. You need to explain clearly how you arrive at your answer.

Question 2.

- (A) Explain in 6–10 lines what a Tragedy of the Commons is.
- (B) Give two real-life examples of a tragedy of the commons.
- (C) Explain how the notion of tragedy of the commons is related to the Prisoner's Dilemma. Include a comparison of game-theoretic features (dominant/dominated strategies, equilibria).

Question 3. Pot-Limit Omaha. Player 1 has $A\clubsuit A\heartsuit K\heartsuit J\clubsuit$ and Player 2 has $7\heartsuit 8\clubsuit 9\clubsuit T\heartsuit$. The board on the turn is $6\clubsuit 7\heartsuit A\heartsuit Q\heartsuit$.

- (a) List all river cards which give Player 2 a winning hand.
- (b) Calculate the probability that the river gives Player 2 a winning hand.
- (c) Suppose the pot on the turn is \$300. Then Player 1 goes all-in for \$200 (rendering the total pot at \$500). What is the EV for Player 2 of calling?
- (d) Based on the EV, should Player 2 call?

Question 4.

(A) Define the two types of Gambler's Fallacy.

(B) Give an example of each type of fallacy.

(C) Explain how the paradigm of heuristics and biases explains how the two types arise.

Question 5.

- (A) Describe in 6–10 lines what the subject matter of *behavioural game theory* is. Contrast behavioural game theory with standard, mathematical game theory.
- (B) Discuss some of the main conclusions drawn by experiments with the Ultimatum game.
- (C) How do the results from behavioural game theory experiments affect the assumption (standard in game theory) that subjects are rational?