COMP30024 Artificial Intelligence - Tutorial Problems (Part 5)

Questions based on exercises from Russell and Norvig (3rd edition) have the original question numbers shown in brackets. Many of these questions are designed to provoke discussion in tutorials, rather than having a simple, closed-form answer.

10. *Making Complex Decisions – Auctions*

10.1 We will conduct a set of in-class auctions to gain experience with each type of auction. The basic process for each auction is as follows:

- The auctioneer reveals the good to be auctioned.
- You are given a card that indicates your *redemption value* (denoted V) for the good. If you win the auction, this is the amount that the auctioneer will give you to buy back the good. You can treat the redemption value as your private value for the good.
- Think of a bidding strategy for the given type of auction. Record the bids made.
- The auctioneer conducts the auction.
- If you win the auction, you "pay" the auctioneer the appropriate amount (denoted W) based on the type of auction. The auctioneer will then "pay you back" your redemption value V. Your profit (or loss) is $P = V - W$.

The above process should be followed for (1) English auction, (2) Dutch auction, (3) first-price sealed-bid auction, and (4) second-price sealed-bid auction. In the case of a sealed-bid auction, you should write your name and bid on a piece of paper, which you pass to the auctioneer.

(a) What strategy did you use in each auction? What strategy did the winner use?
(b) How did the amount paid to the auctioneer vary between auctions?
(c) How did the profit of the winning bidder vary between auctions?

10.2 Give a simple intuitive explanation of why the best strategy for bidders in a second-price, sealed-bid auction is to bid your private value.

10.3 Consider an auction site that was advertised on late night television. In the type of auction used by this site, potential bidders pay a fixed amount for the right to make a certain number of bids, e.g., $10 for 20 bids. When a good (such as an iPad) comes up for auction, bidders can make a fixed size bid of 1 cent. The auction terminates once a period of time (maybe 20 seconds) has elapsed with no bids. The winning bidder pays the final price. In practice, goods worth hundreds of dollars are sold for $10-50.

What are the advantages and disadvantages of this type of auction design from the perspective of the auctioneer and the bidders?

11. *Robotics*

11.1 Suppose for some environment, the odds of there being an obstacle present are 1 in 10 and that a range sensor has a false positive rate of 30% and a false negative rate of 30%.

a. What is the probability that an obstacle is present if the detector returns three positives in a row?
b. What is the probability of no obstacle if the detector returns a positive followed by a negative?