COMSM2006 Assessment 2012

Either:

(A) write a 4,000-word essay on regulation of automated trading

Or:

(B) Write a short paper reporting on experiments with simple automated trading 'robots' on the Bristol Stock Exchange.

Set: Thursday October 25th 2012

Due: Monday Decemeber 10th 2012

This assessment is worth **50%** of your total unit credit.

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Option A: 4,000-word essay on Regulating Automated Trading

On October 23rd 2012, the UK Government Office for Science released the final report of a two-year "Foresight" enquiry into the future of computer trading in the financial markets. The final report is available to download from here:

http://www.bis.gov.uk/assets/foresight/docs/computer-trading/12-1086-future-of-computer-trading-in-financial-markets-report.pdf

Two background "driver review" documents, commissioned by the Foresight project, that you should read are available here:

DR3: http://www.bis.gov.uk/assets/foresight/docs/computer-trading/11-1222-dr3-technology-trends-in-financial-markets.pdf

DR4: http://www.bis.gov.uk/assets/foresight/docs/computer-trading/11-1223-dr4-global-financial-markets-systems-perspective.pdf

For this assessment you should write an essay of no more than 4,000 words explaining what, if anything, you think should be done to regulate automated trading in financial markets. The essay should be self-contained, so should start with a summary of the technology developments discussed in the Foresight reviews DR3 and DR4, and Chapter 2 of the Foresight Final Report.

You can choose to argue that nothing needs to be done (in which case you should say *why* that is the case) or you can choose to argue that specific measures need to be introduced by market regulators/legislators, in which case you should say why those measures are necessary, and how they would help.

The grading for this will be a mark out of 20, generated by rating the essay on a five-point scale for each of four criteria: (1) structure of report and general quality of writing; (2) summary of the technology developments discussed in DR3, DR4, and Chapter 2 of the Foresight Final Report; (3) appropriate use of literature **other** than the sources you have been asked here to read; and (4) originality and quality of your argument.

Option B: Eight-page research paper on automated trading strategies

The *Bristol Stock Exchange* (BSE) is a simple minimal simulation of the core data-structure on most technology-enabled financial markets: the *Limit Order Book* (LOB). BSE is written in Python, and includes code for five simple automated trading "robots" called *Giveaway*, *ZIC*, *Shaver*, *Sniper*, and *ZIP*.

The source-code for BSE (*BSE.py*) and its documentation (*BSEguide.pdf*) can be downloaded from GitHub, via this URL:

https://github.com/davecliff/BristolStockExchange/downloads

NB: BSE is still under development and you can expect updates to be on GitHub from time to time over coming weeks/months.

For this assessment option, you should implement one or more new types of trading robot in BSE, explore the behaviour of the new traders by running sensibly structured comparative experiments, and then analyze the results from those experiments using appropriate visualization and statistical methods. Finally you should write a brief report that clearly explains how the additional trader robots work, the design and analysis of the experiments, and their outcome. Your report should be in the style of an academic research paper, as if you were going to submit it to a conference for peer-review.

You might want to implement someone else's trading algorithm, such as "GD" by Gjerstad & Dickhaut (1998)[1], which, like ZIP, was demonstrated in modified ("MGD") form by Das *et al.* (2001) to outperform human traders; or you might want to try the more recent "AA" by Vytelingum (2006), which currently seems to be the best published trading strategy for market experiments like these; see De Luca *et al.* (2011) and Cartlidge *et al.* (2012) for further discussion.

The *minimum* you could do here is to implement one of either MGD or AA as your "new" strategy and report on how the performance of robot traders with that strategy compares with that of one or more of the robot-types already included in BSE.

But you may also want to experiment with writing your own algorithm. It is fine if you want to start by implementing a previously-published algorithm like ZIP or MGD or AA, and then alter or extend it – that's how a lot of progress in science and engineering is made. But if you want to start from scratch, that is absolutely fine too.

We're not *requiring* you to write a new (or revised) algorithm, but you can probably pick up some extra points by at least trying to do so: your algorithm certainly doesn't have to be world-beating, but you *are* expected to explain the design choices you made and to show that you know how to experimentally evaluate a new trading algorithm in the relatively simple context of BSE.

If you want to work with other people, that's fine: we'll accept joint work from teams of two or three people, but no more than three.

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[1] Full details of the literature cited here are given in the "References" section of `BSEguide.pdf`.

Your robot code has to be in Python (preferably version 2.6 as that's one of the versions available on the standard build for the PCs in the Engineering Faculty labs, and its also the version that ships as standard on Apple Macs), and it has to be a subclass of the `Trader` class defined in BSE.py (in the same way that `Trader_ZIP` and all the others discussed in this document are). Along with your paper, we would like you to submit the source-code for your trader class, but that is the **only** code that we want from you: we are not interested in any changes you make to the other classes or methods or functions in BSE: all that matters is your trader code.

We will randomly select some of your submissions for test-runs: we'll take your trader code and run it in the open-source release of BSE.py, to check that the results in your paper are independently replicable. If we can't replicate your results within reasonable error margins, the grade you get will be **severely** reduced. The bottom line is: (a) to be safe, don't make any substantive changes to BSE except for the Trader sub-class that you edit; (b) don't fake or edit your results, because that is fraud (and fraud is at least as bad as plagiarism).

For fun (i.e., **not** part of the formal assessment) we plan to run a tournament of the trading robots that are submitted for assessment. The full details of this tournament will depend in part on exactly how many robots we get submitted: the current plan is to run it a bit like the soccer World Cup: a random draw to assign each trader to a group; a round-robin contest within the group to determine the top performers in each group; and then a knockout contest leading to quarter finals, semi finals, and then a grand final contest (plus a playoff for third place). For a comparison of two robot types, experiments would involve varying the proportions of the two robots in the market, and altering the nature of the supply and demand schedules. Or, alternatively, we might just run a large number of market sessions with one robot of each type present in the sellers, and one of each type in the buyers too.

Note that if you submit a robot algorithm for this assessment, that submission is taken as your definite consent that the algorithm you submit can be used in this way, and that full details of your algorithm (including source code listing) can be given in any publications (e.g. print, and/or online) that describe the outcome of the tournament.

(If you happen to come up with a trader algorithm that outperforms all the others, we would like to be able to write that up as a research paper, with you as one of the co-authors of course.)

The marking scheme is as follows:

- **Quality of Experiment Writeup - 25%**
  How well is the paper structured? How clearly does it explain what you have done?
- **Quality and Presentation of Results - 25%**
  How thoroughly is the experiment carried out? How clearly are the results presented? Clarity of figures, etc
- **Quality of Statistical Analysis and Conclusions - 25%**
  Is an appropriate statistical analysis chosen and conducted correctly? Are correct conclusions clearly drawn from the analysis and explained?

- **Challenge and Originality - 25%**
  How challenging was the task you set yourself? How complex were the agents and the experimental setup? How extensive was the analysis?

Your paper should be formatted according to the ACM conference-proceedings format, templates for which are available here:
http://www.acm.org/sigs/publications/proceedings-templates

Your paper should be no longer than eight pages in ACM format, including all figures, references, and any segments of code you include to explain your algorithm. The full code for your algorithm should then be included as an appendix, for completeness.