EPSRC Vacation Scheme: Mid-Project Review

Matthew Knowles

Department of Mathematics
University of York

mk1320@york.ac.uk

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Goals

1. Implement Convex Hull Approximation

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2. Look into making it more efficient

Task 1 Progress

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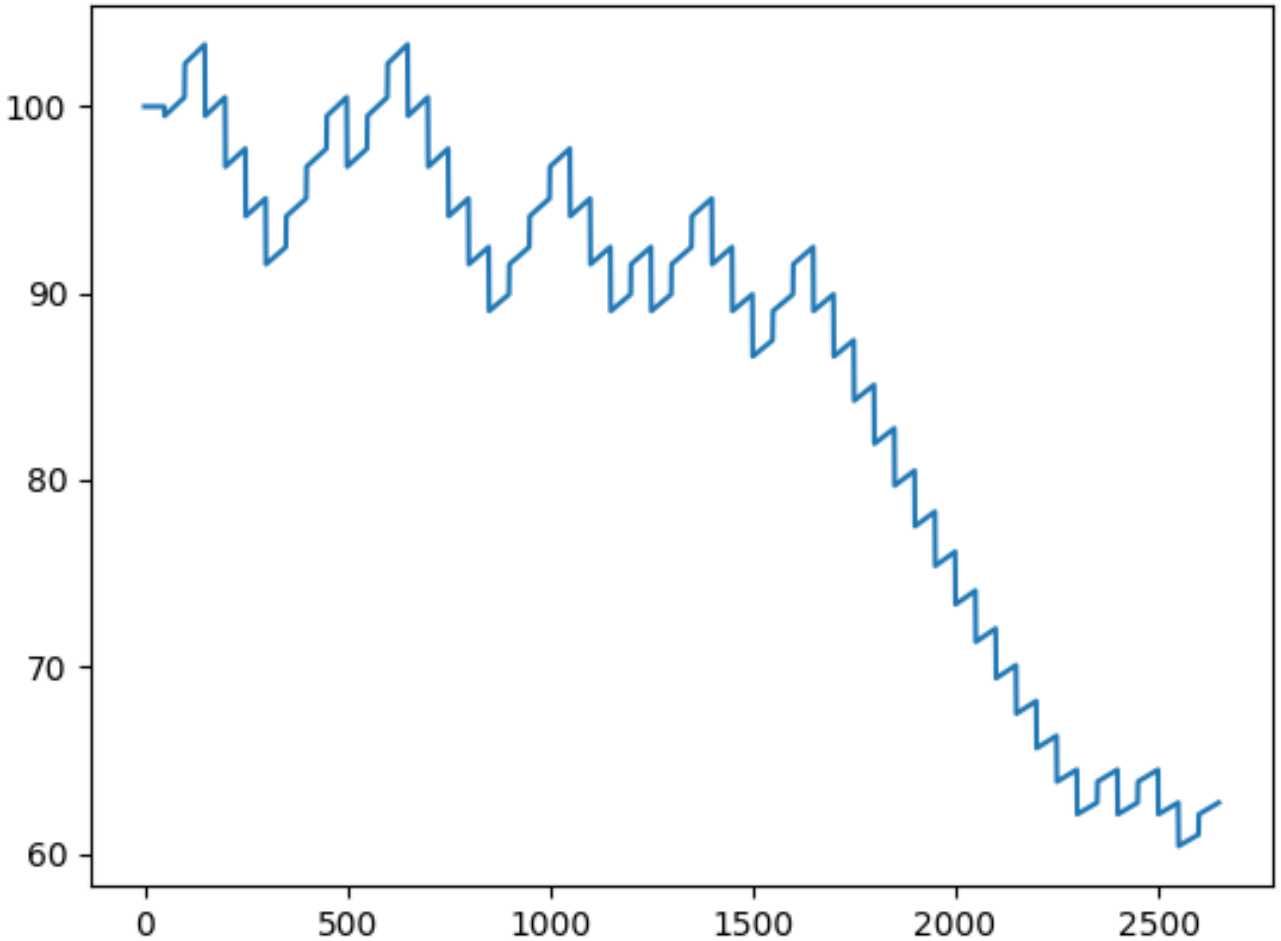
- Arguably spent too long worrying about something not entirely related
- Switched from Thesis to paper as to not worry too much about generalisation

Fixing the discontinuity



Issues

- Well it's not convex for a start

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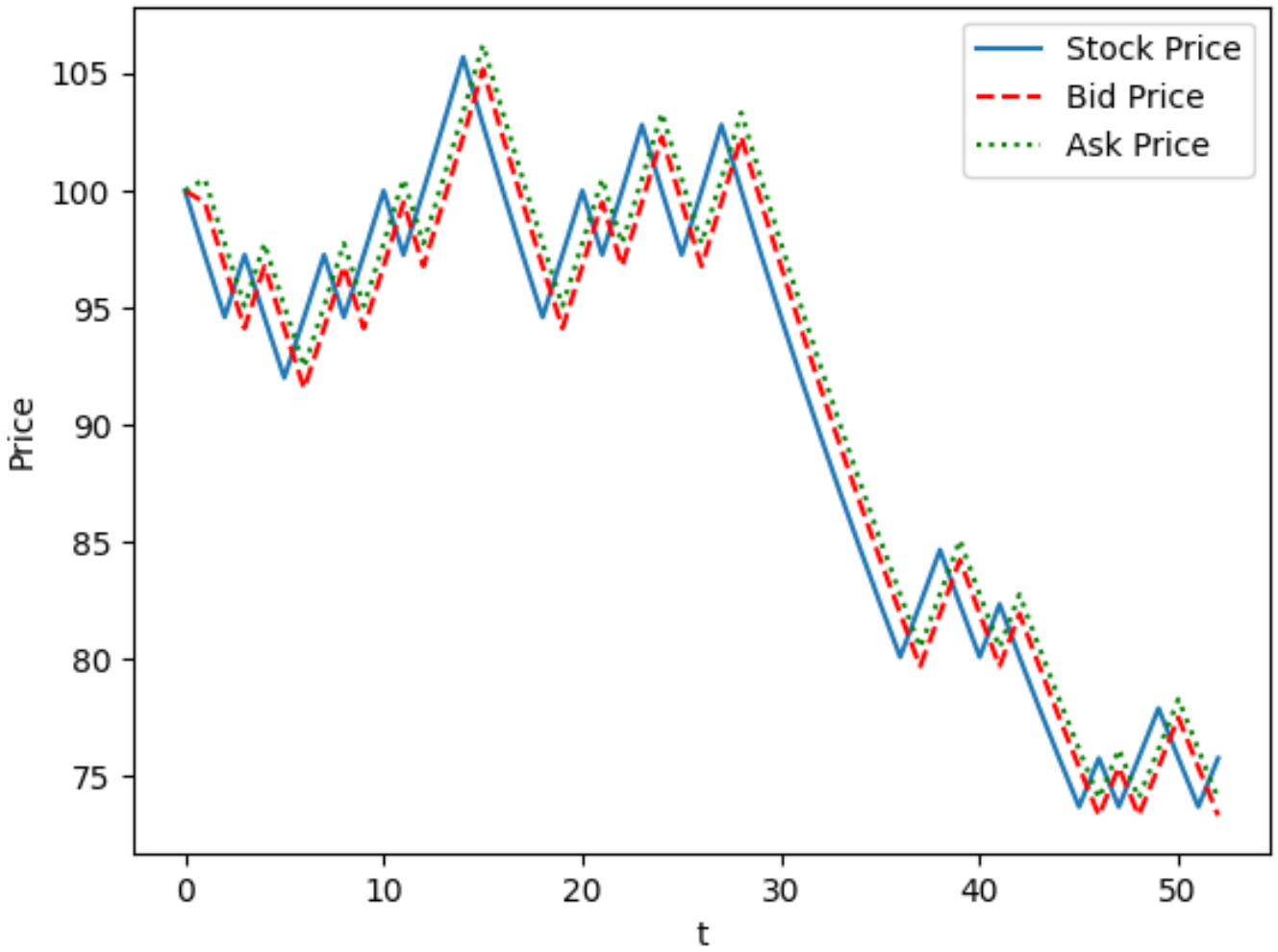
- Also not really a hull
- Hope is not lost: Enter RouxHull!

Random Walk


Stock Price
Bid Price
Ask Price
105
100
95
90
85
80
75
Price
0
10
20
30
40
50
t

Next steps!

- The above graph is taken from:

$$S_{t+1} = \begin{cases} e^{\sigma\sqrt{\frac{1}{52}}} S_t, & p \\ e^{-\sigma\sqrt{\frac{1}{52}}} S_t, & 1-p \end{cases}$$

  (Roux, 2021)
- Calculate bid and ask prices via $S_t^a = (1+k)S_t$, $S_t^b = (1-k)S_t$
- Create $n-1$ subintervals for each $t = 0, \ldots, T-1$ via:

$$s_t^i = S_t^b + \frac{i-1}{n-1}\left(S_t^a - S_t^b\right)$$

  for $i = 1, \ldots, n$

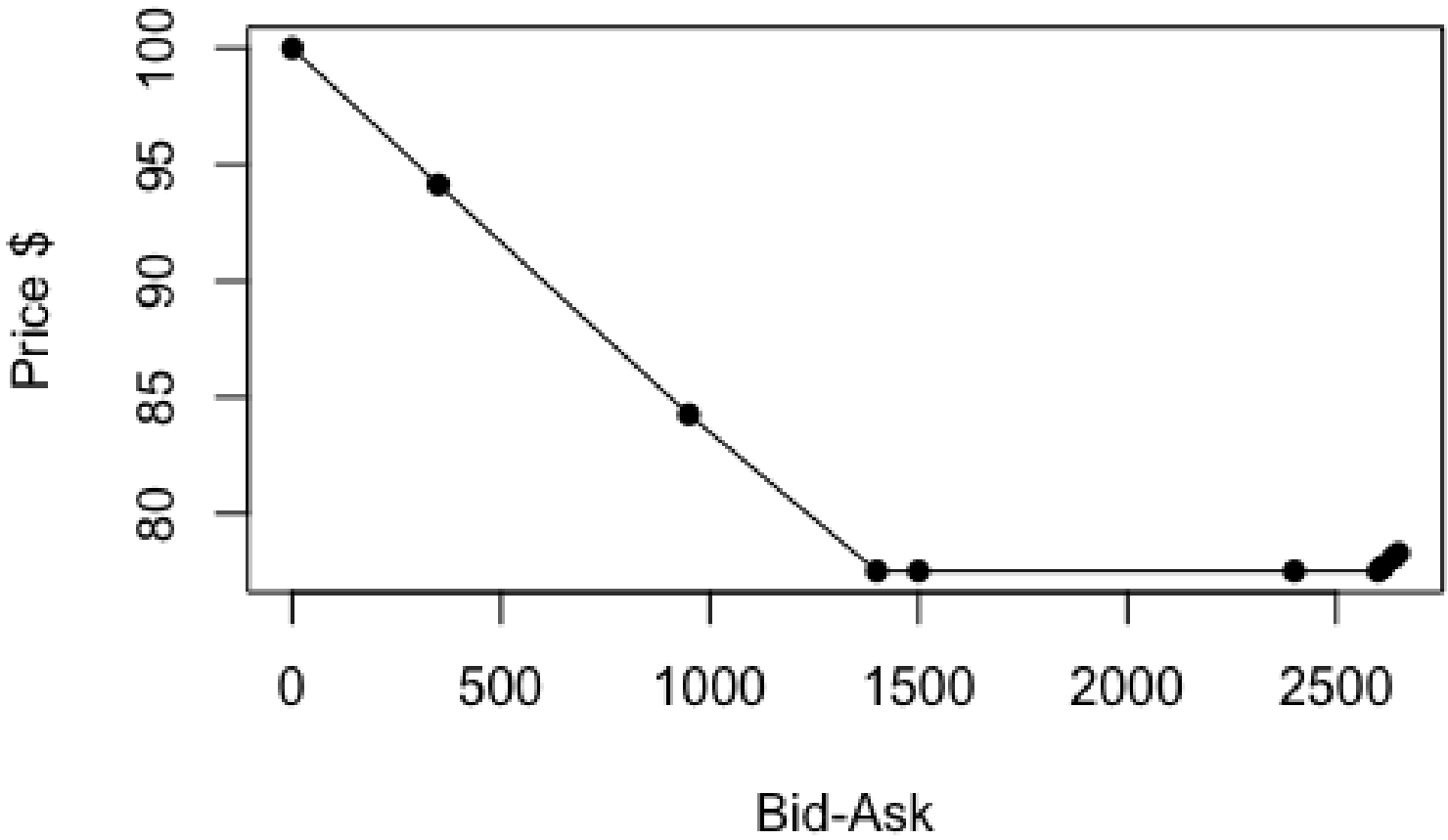
Next steps! (contd)

- Now implemetnt (A.10) from 2021 paper

$$\hat{f}_k(x) = \begin{cases} f(\hat{x}_{kl}) & \text{if } x = \hat{x}_{kl} \\ \frac{\hat{x}_{kl}-x}{\hat{x}_{kl}-\hat{x}_{k[l-1]}}\hat{f}_k(\hat{x}_{k[l-1]}) + \frac{x-\hat{x}_{k[l-1]}}{\hat{x}_{kl}-\hat{x}_{k[l-1]}}\hat{f}_k(\hat{x}_{kl}) & \text{if } x \in (\hat{x}_{[l-1]}, \hat{x}_l) \\ \infty & \text{if } x \notin [b, a] \end{cases}$$

- With this, apply RouxHull to get the upper approximation

A hull!



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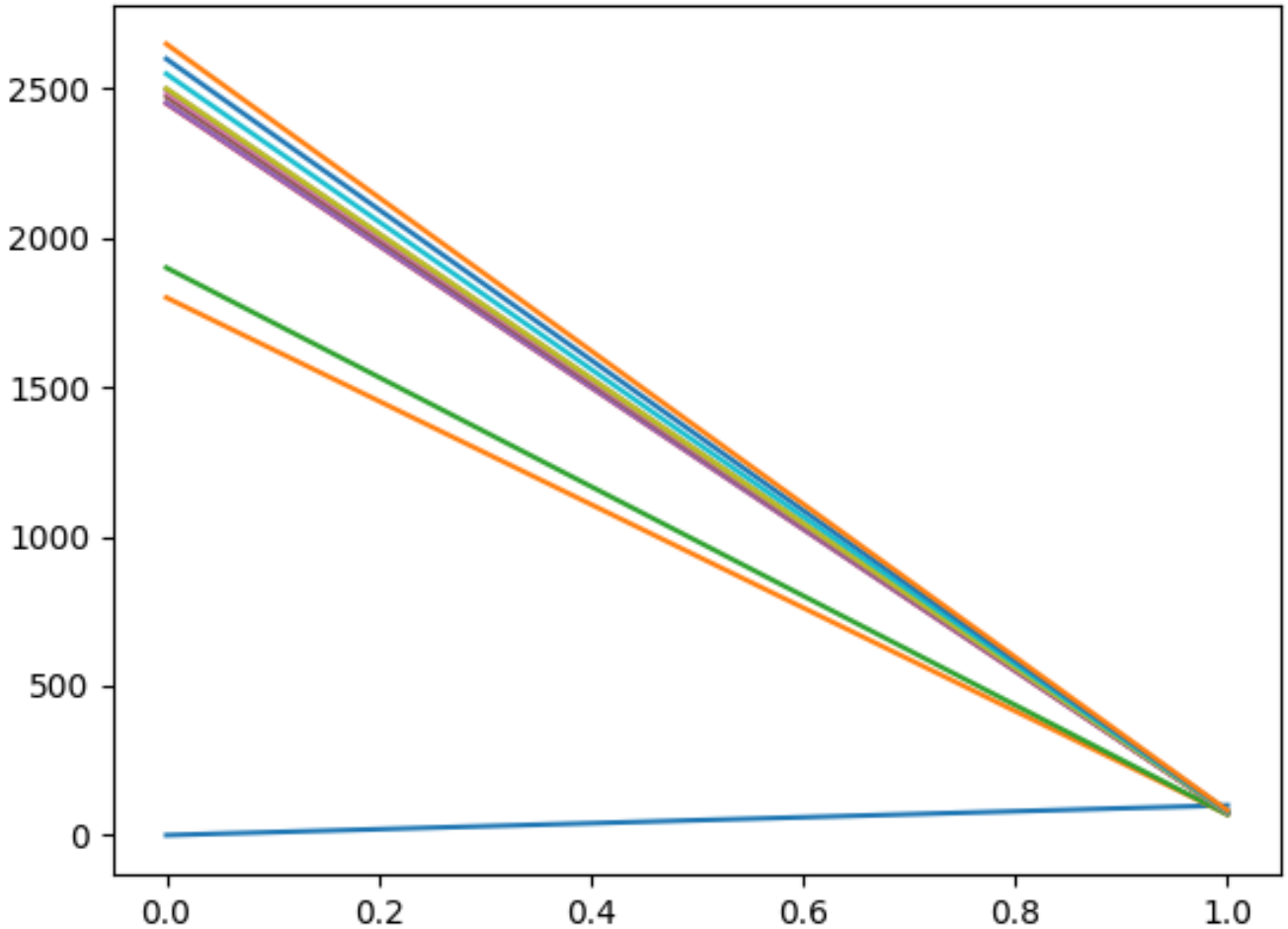
- Genetic Algorithms??

Some bloopers



I have no idea how to explain this