**Problem Set # 5**

**Problem 1: Numerical PDEs:**

1. This instrument isn’t same as hold a real American option, because for a American option, which can be executed at any time, we can’t choose a suitable time. And also, when we short a position, it’s not our right to execute the option.
2. I search it on Federal Reserve Economic Data and the riskless rate is about: **0.5**, I think FRED is a really official website where the data is reliable.
3. We can calculate the implied volatility from its history, we use the std of SPY the past year and then compute the volatility. The volatility is about **0.148**
4. I choose Smax as **550** because I think the price won’t be higher that 550 during this period. I choose hs as **275**, ht as **1000**. Because I want to more discretization of time T to make the result more accurate.
5. Here’s the brief view of eigen Value of A:

电脑屏幕截图

中度可信度描述已自动生成

And we check the absolute value: 图形用户界面, 文本

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1. As our discretization follows the linear relation, so we can use the interpolation of linear method to choose today’s price. In python, I use np.interp(), then I get today’s price is about **2.1**
2. Using the same methods, but follow the American style, the price is about: **4.17**
3. The premium is about: **2.1**. I think this result is reasonable. American option (right of early exercise) offers people more benefits. That’s why the price is more expensive to cover the benefit.