

AI-Written Code in Jupyter Notebooks

MGMT 675: Generative AI for Finance

Kerry Back

A Different Approach

Code Environment + Chatbot

- ChatGPT and Claude: Chatbots with code execution added
- Google Colab: Code execution environment with chatbot added
- Colab started as Jupyter notebooks in the cloud (2017)
- Gemini was integrated into Colab later (2024)
- Philosophy: Write and run code first, use AI to assist

What is Google Colab?

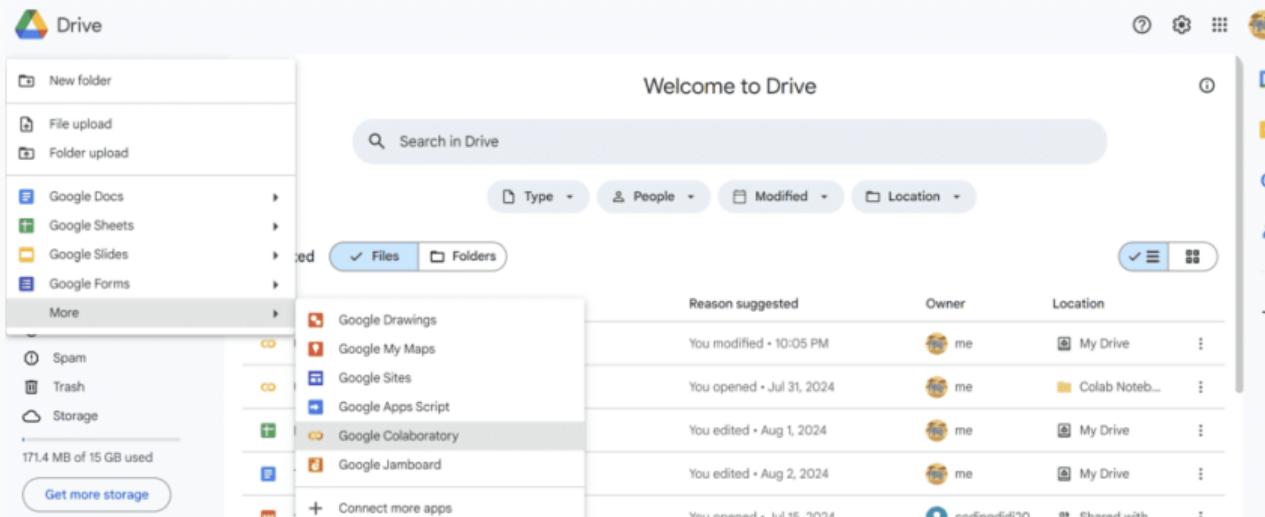
- A free tool from Google for running code in your browser
- No software installation required
- Works on any computer with internet access
- All your work saves automatically to Google Drive

What You Need

- Just two things:
- A Google account (Gmail works)
- A web browser (Chrome recommended)
- That's it!

Accessing Colab: From Google Drive

Click New → More → Google Colaboratory



Accessing Colab: Direct

colab.research.google.com

The Open Notebook Dialog

Open notebook

Examples >

Recent > Recent

Google Drive >

Github >

Upload >

Search notebooks

Title	Last opened	First opened
Welcome To Colab	8:48 AM	Mar 26, 2020
Untitled36.ipynb	12:04 AM	12:04 AM

+ New notebook Cancel

Variables Terminal

Search

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Opening Notebooks

- Examples: Google's tutorial notebooks
- Recent: Your recently opened notebooks
- Google Drive: Notebooks saved in your Drive
- GitHub: Open notebooks from GitHub repos
- Upload: Upload a .ipynb file
- Click + New notebook to start a fresh notebook

The Colab Interface: Notebook + Gemini

The screenshot shows the Google Colab interface with the following elements:

- File Bar:** Untitled37.ipynb, Star icon, File, Edit, View, Insert, Runtime, Tools, Help.
- Toolbar:** Share, Connect, Run all, Cell, Text, Code, Commands.
- Notebook Area:** A code cell with the placeholder text "Start coding or generate with AI." and a play button icon.
- Left Sidebar:** Icons for file operations (New, Open, Save, Find, Copy, Paste, Delete, Undo, Redo), a key icon, and a folder icon.
- Bottom Buttons:** How can I install Python libraries?, Load data from Google Drive, Show an example of training a, What can I help you build?, Gemini 2.5 Flash, Terminal, Variables.
- Bottom Navigation:** Variables, Terminal, Gemini logo.

How Notebooks Work

- Three elements: notebook, notebook interface (Colab or other), and Python runtime environment
- A notebook (.ipynb file) is just a text file
- The interface renders the file to create what you see and handles communication with the runtime environment
 1. When you run a cell, the code is transmitted to a runtime environment (called a kernel).
 2. The runtime processes and executes your code.
 3. Results flow back to the notebook interface.
 4. The interface renders outputs, visualizations, and any error messages.

Navigating a Notebook

- + Code: Add a new code cell
- + Text: Add a text/markdown cell
- Connect: Connect to Google's servers
- Files (folder icon): View and upload files

What is a Cell?

- A cell is a box where you write code or text.
- Two types:
- Code cells: Run Python code
- Text cells: Write notes and explanations
- You can have as many cells as you need.

Your First Code: Simple Math

Type $5*3$ and press Shift + Enter → Result: 15

A screenshot of a code editor interface. At the top, there is a toolbar with icons for up, down, edit, delete, and more. Below the toolbar, the code $5*3$ is typed into the editor. To the right of the code, the result 15 is displayed. A blue bracket is drawn around the code and its result. On the left side of the editor, there is some faint text that appears to be part of another line of code.

Your First Code: Hello World

Type `print('hello world')` and press Shift + Enter



The image shows a Jupyter Notebook cell interface. The cell has a status bar indicating [2] and 0s. The code input is `print('hello world')`. The output pane shows the result of the execution: `... hello world`. To the right of the output, there is a toolbar with icons for up, down, edit, delete, and more.

Running Code: Three Ways

- Click the play button (>) on the left of the cell
- Press Shift + Enter (runs and moves to next cell)
- Press Ctrl + Enter (runs and stays in cell)
- Tip: Shift + Enter is the most common method

Understanding the Play Button

- Before running:
- Circle with play icon (>) - Cell is ready
- While running:
- Spinning circle - Code is executing
- After running:
- Checkmark - Output appears below

Cell Numbers

- Notice the [1] or [2] next to cells?
- Shows the order cells were run
- Empty [] means not yet run
- * means currently running
- Important: Can run cells in any order but top to bottom avoids confusion.

Adding New Cells

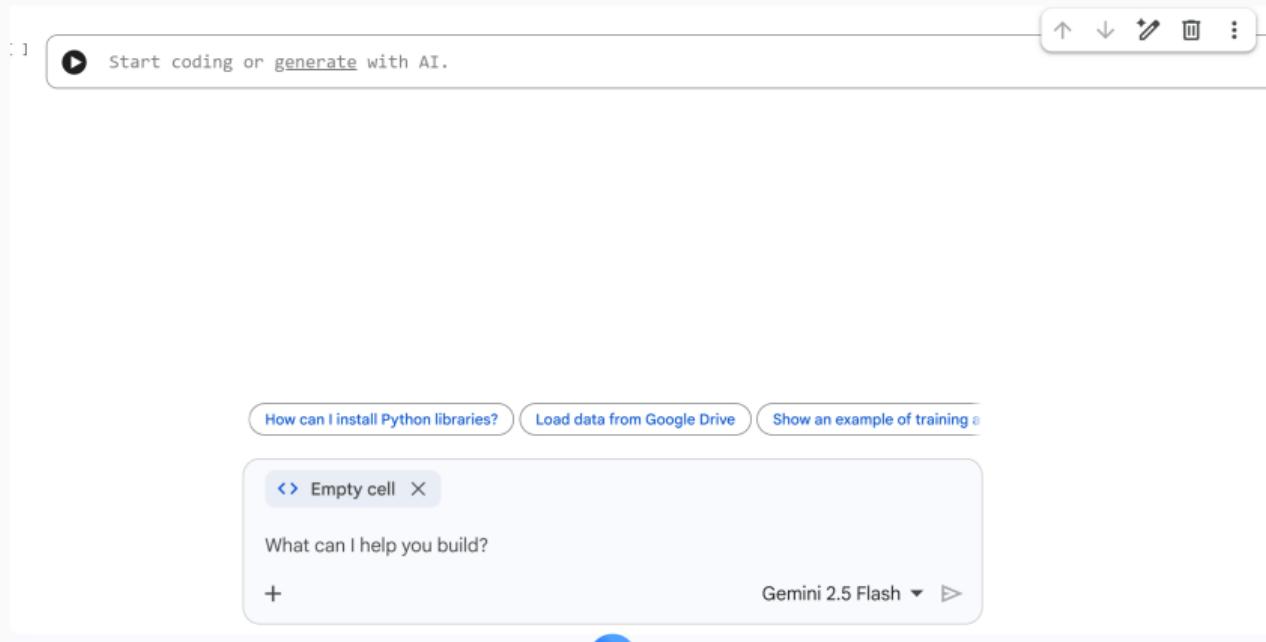
- From the toolbar:
- Click + Code for a code cell
- Click + Text for a text cell
- Using keyboard:
 - Ctrl + M, B → Add cell below
 - Ctrl + M, A → Add cell above

Deleting and Moving Cells

- To delete a cell:
- Click the trash icon in the cell toolbar
- Or: Ctrl + M, D
- To move a cell:
- Click the up/down arrows in the cell toolbar
- Or drag and drop the cell

Meet Gemini: Your AI Assistant

Gemini is built into Colab to help you write code



What Gemini Can Do

- Generate code from plain English descriptions
- Explain what existing code does
- Fix errors in your code
- Suggest improvements
- Answer Python questions

Runtime: What Powers Your Code

- When you click Connect, Colab gives you a virtual computer:
- CPU (standard processing)
- RAM (memory)
- Disk space
- And optionally: GPU or TPU for machine learning

Restarting the Runtime

If your code isn't working as expected:

Runtime → Restart runtime

This clears all variables and starts fresh.

Note: You'll need to re-run your cells after restarting

Session Limits

- Sessions disconnect after ~90 minutes idle
- Maximum ~12 hours continuous use
- Limited GPU/TPU hours per week

Get Started

1. Ask Gemini to get monthly GDP data from FRED using the pandas-datareader library.
2. Ask Gemini to plot GDP over time as a line chart.
3. Ask Gemini how you can save the chart.
4. Ask Gemini how you can save the GDP data as a CSV file.
5. Ask Gemini how you can save the notebook.

Reading Data Files in Colab

- Download the file to your **Google Drive** (e.g., to My Drive or a subfolder)
- In your Colab notebook, ask Gemini to **mount your Google Drive**
- Gemini will generate code like:
 - `from google.colab import drive`
 - `drive.mount('/content/drive')`
- Run the cell and authorize access when prompted
- Your Drive files are now at `/content/drive/MyDrive/...`
- Ask Gemini to load the file with pandas — it will use the correct path and reader (`read_excel`, `read_csv`, etc.)

When unsure about anything in Colab, ask Gemini.

Exercise: Computing Returns

- Download [prices-dividends.xlsx](#) to your Google Drive
- Ask Gemini to mount your Google Drive
- Ask Gemini to compute daily returns including dividends
- Ask Gemini to calculate annualized mean return and volatility

Exercise: Estimating Betas

- Download [exercise10-betas.xlsx](#) to your Google Drive
- Ask Gemini to mount your Google Drive
- Ask Gemini to estimate betas for each stock using regression
- Ask Gemini to interpret the results

Exercise: Pairs Trading Signals

- Download [pairs-ko-pep.xlsx](#) (or [pairs-f-gm.xlsx](#)) to your Google Drive
- Ask Gemini to mount your Google Drive and load the price data
- Ask Gemini to compute the price ratio of the two stocks and plot it over time
- Ask Gemini to compute the rolling 30-day z-score of the ratio and plot it, with horizontal lines at ± 1 and ± 2
- Ask Gemini to highlight dates where the z-score crosses ± 2 (potential entry signals) and where it returns to 0 (potential exit signals)