INTRO AND SIMULATION

MGMT 675
AI-Assisted Financial Analysis
Kerry Back

RICE | BUSINESS
Jones Graduate School of Business

MEET YOUR PROF

- At Rice since 2009, in Jones and also Econ Dept.

    - teaching intro to finance, data-driven investments, investments theory, and python for business research

    - to PhDs, MBAs, and Masters in Data Science students

- Previously at Northwestern, Indiana, Washington Univ. in St. Louis, and Texas A&M. Associate dean at Wash U.

- Former and current editor and associate editor of several journals. Two textbooks (derivatives and PhD asset pricing theory). Materials and info at kerryback.com.

WHY ARE WE HERE?

LET'S DO SOME TIME TRAVELING
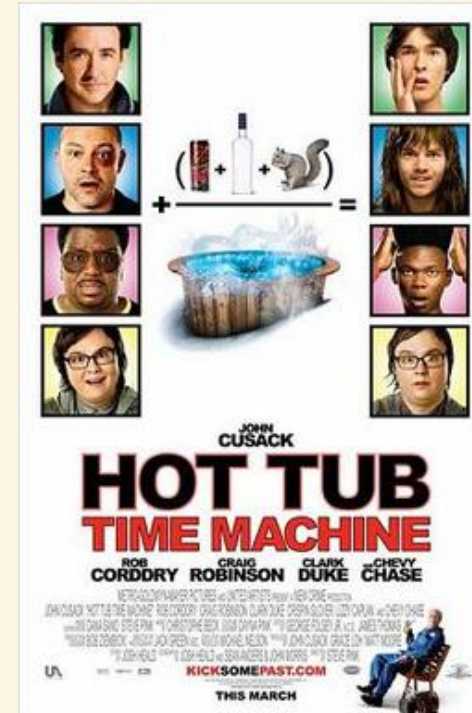
First hand-held calculator, introduced by Texas Instruments in 1972

First financial calculator, introduced by HP in 1973

VisiCalc, released for Apple II in 1979

Lotus 1-2-3, released for IBM PC in 1983
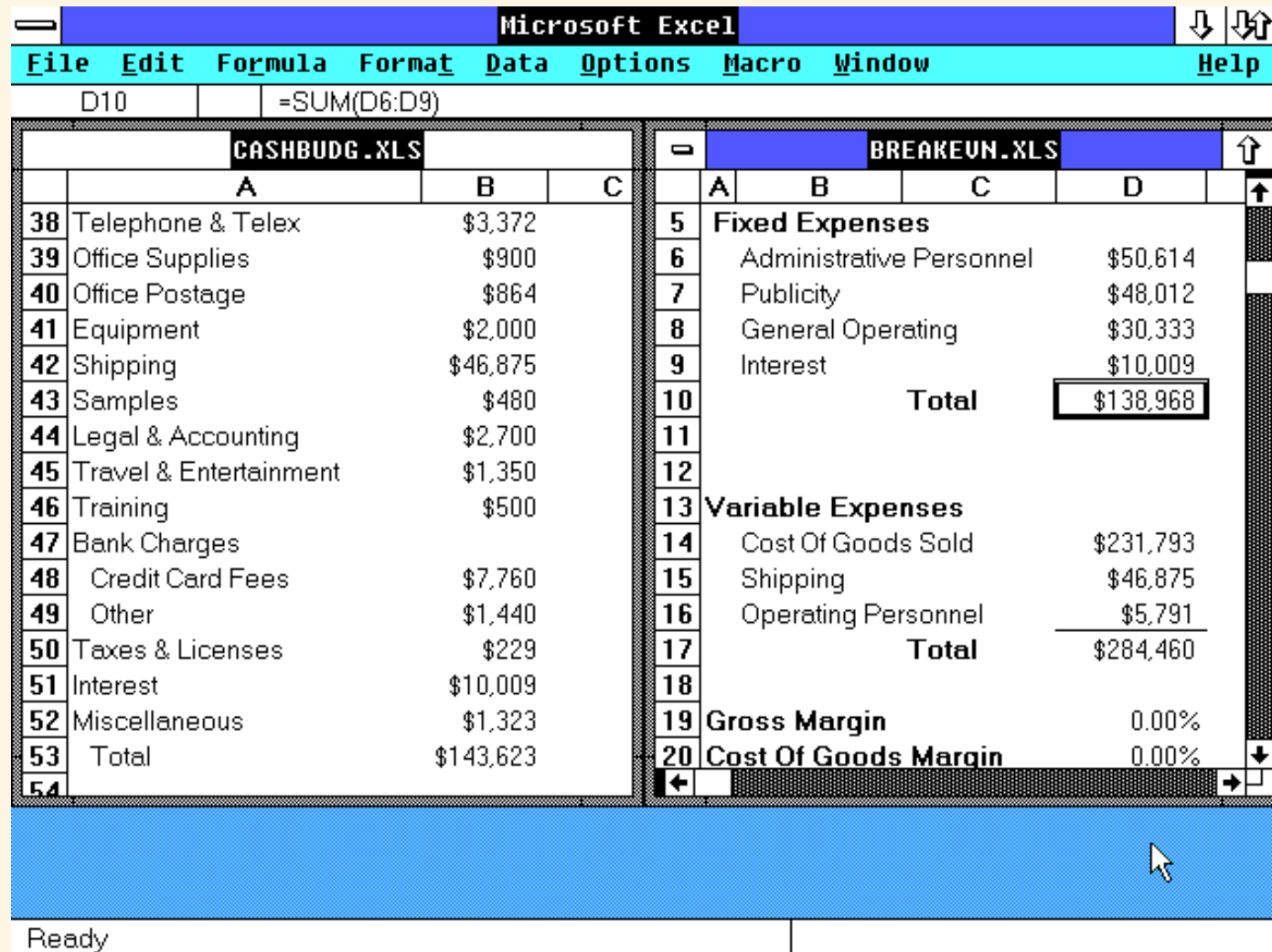
Microsoft Excel, released for Windows in 1987

TODAY'S TOOLS

- Will Excel survive?

- Will Excel retain its dominance?

MAYBE ...
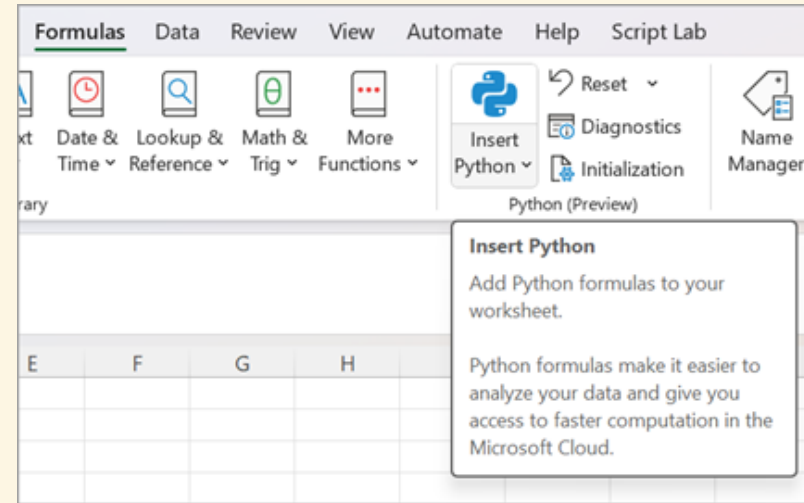
THE BEST WE HAVE TODAY (I THINK)

WHAT JULIUS DOES

- Python interpreter and proprietary LLM

- Julius executes and debugs code

- Provides links to images, tables, datasets it creates

- Provides download of conversation (and code) as Jupyter notebook or Word doc

- Allows us to upload our own data

- Can get some online data

- Can install any python libraries not pre-installed

GET A JULIUS ACCOUNT

- Free account has very strict message limit

- Basic allows 250 messages per month. Maybe enough?

- Essential allows unlimited messages.

- 50% academic discount. Sign up using your Rice email and enter the promo code STUDY2024.

WARM-UP

- Ask Julius to plot the function $y = x^2$.

- Ask Julius to plot the payoff diagram of a call option with a strike of 100.

- Ask Julius to use pandas datareader to get the 10-year Treasury yield from FRED, plot it, and save as a jpeg.

- Ask Julius to use yfinance to get AAPL's adjusted closing price from Yahoo Finance, plot it, and save as a jpeg.

RETIREMENT PLANNING AND SIMULATION

TOPICS

- Long-run risk

- Retirement planning

- Retirement planning with simulation

- Monte-Carlo option valuation

- Monte-Carlo stock valuation

LONG-RUN RISK

- Ask Julius to simulate how much a $1 investment would grow to in 10 years if the investment return is normally distributed with a mean of 6% and a standard deviation of 20%.

- Ask Julius to calculate the fraction of times the investment outperforms a risk-free return of 1% over 10 years.

- Ask Julius to generate boxplots and histograms of the ending investment account balance.

RETIREMENT PLANNING

- Tell Julius you want to check if a retirement savings plan is feasible.

- Ask Julius what information you need to provide and provide it.

- Ask Julius to calculate the ending balance as a function of the rate of return over some range and plot it.

RETIREMENT PLANNING WITH SIMULATION

- Ask Julius to simulate the retirement plan assuming the annual returns are normally distributed with some mean and variance.

- Ask Julius to describe the distribution of ending account balances and to produce a boxplot and histogram.

MONTE-CARLO OPTION VALUATION

- Tell Julius you want to value a European call option by Monte Carlo. Ask Julius what information you need to provide and provide it.

- Ask Julius to value the same call option using Black-Scholes.

- Ask Julius to value a put option both ways.

TWO-STAGE GROWTH MODEL

- Give Julius the following data (from Applied). Then ask what the share price should be.

    - A firm with no debt will have free cash flow of 100M next year.

    - The cash flow will grow by 12% per year for years 2 through 5. Then, it will grow by 3% per year forever.

    - The firm's cost of capital is 10%, and there are 44.75M shares outstanding.

CHECK FOR ERRORS

- It is quite possible that Julius - like any assistant - might misunderstand the timing you want.

- Quickest way to fix mistakes: edit the code.

Check the following:

- There should be five cash flows in the first stage.

- The first cash flow should be 100M (no growth).

- The terminal value should be 100M with 4 years of growth at 12% and 1 year of growth at 3% divided by (10% - 3%).

- The terminal value should be discounted back 5 years.

SENSITIVITY ANALYSIS

Ask Julius to vary the first stage growth rate between 6% and 18% and to plot the share price as a function of the growth rate.

MONTE-CARLO VALUATION

- Now ask Julius to simulate the first-stage growth rate from a normal distribution with a mean of 12% and a standard deviation of 3%.

- Ask Julius to compute the share price in each simulation and to describe the share price distribution.

- Ask Julius to produce a histogram of the share price distribution.

A SECOND SOURCE OF UNCERTAINTY

- Tell Julius to model the first-stage growth rate as x + y where x is drawn from a normal distribution with a mean of 12% and a standard deviation and y is a Bernoulli random variable which is 12% with 10% probability and is 0 with 90% probability.

- Ask Julius to compute the share price in each simulation and to describe the share price distribution.

- Ask Julius to produce a histogram of the share price distribution.