

The background of the image is a soft-focus, monochromatic landscape. It features a prominent, dark, craggy rock formation or cliff face on the left side. Several tall, thin pine trees are scattered across the rock face and its base. In the upper right area, there's a cluster of trees and a small, dark, rectangular stone structure, possibly a ruin or a fortification, perched on the edge of the cliff. The overall atmosphere is hazy and ethereal, with a thick mist or fog filling the lower half of the frame.

RE 2708

# COMPUTER THINKING

A N D P R O G R A M M I N G

## Lecture 1 Introduction



### CONDITIONAL STATEMENTS (IF-THEN-ELSE)

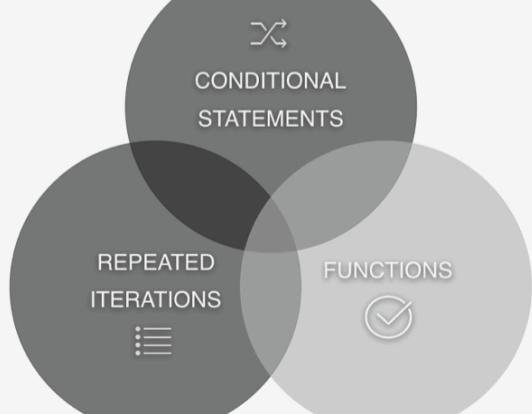
Most of our thoughts are decisions! Similarly, most of the operations that we ask the computer to do for us are conditional statements.

### REPEATED ITERATIONS (FOR)

The primary reason to use a computer at all is because it can perform repetitive tasks.

### FUNCTIONS

The reason why we write functions is to be able to apply the same operations to many different objects.



## Lecture 2

### FEATURES (PROPERTIES) and

### METHODS (PROCEDURES/ROUTINES)

## Lecture 3



## O B J E C T S

## Lecture 1 Introduction



### CONDITIONAL STATEMENTS (IF-THEN-ELSE)

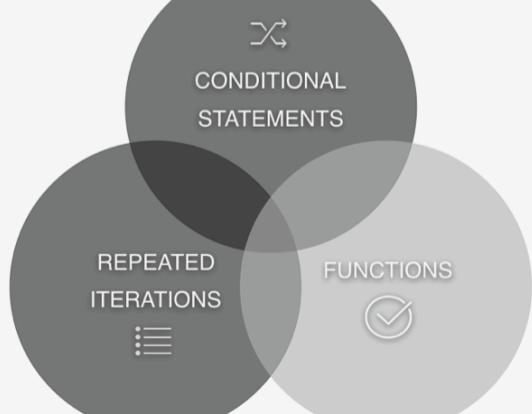
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### FUNCTIONS

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## Lecture 2

### FEATURES (PROPERTIES) and

### METHODS (PROCEDURES/ROUTINES)

## Lecture 3



## O B J E C T S

1

## Applications

2

## Real estate financial modeling

+ Working with buttons



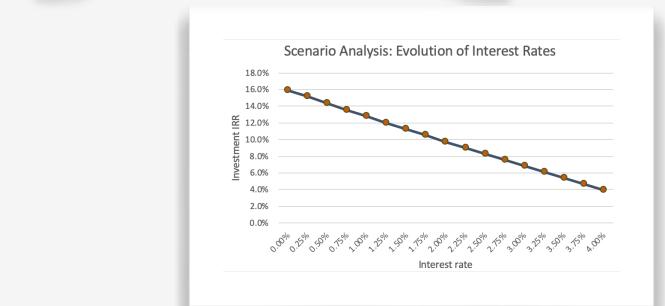
| A                       | B        | C     | D                 | E               | F          | G            | H               |
|-------------------------|----------|-------|-------------------|-----------------|------------|--------------|-----------------|
| Tenant                  | Location | Unit  | Start of contract | End of contract | Floor area | Rent (\$SGD) | Revision period |
| 1. SushiTei             | C2       | #0-4  | 2017-04-03        | 2019-10-08      | 125 sqm    | \$5,250.00   | Monthly         |
| 2. SushiTei             | C2       | #1-1  | 2017-01-01        | 2022-07-31      | 2740 sqm   | \$82,200.00  | Monthly         |
| 3. Marks and Spencer    | B3       | #1-5  | 2018-02-01        | 2019-10-28      | 75 sqm     | \$3,300.00   | Monthly         |
| 4. 7 Eleven             | B3       | #0-3  | 2019-05-14        | 2019-10-31      | 450 sqm    | \$21,150.00  | Fixed           |
| 5. Zara                 | C1       | #0-7  | 2017-04-03        | 2019-12-30      | 195 sqm    | \$6,435.00   | Fixed           |
| 6. Burger King          | B3       | #1-31 | 2017-01-01        | 2022-07-31      | 40 sqm     | \$2,000.00   | Fixed           |
| 7. Swarovski            | A2       | #2-5  | 2016-01-01        | 2019-12-30      | 32 sqm     | \$1,184.00   | Monthly         |
| 8. 8 Tarts-n-Pastries   | A2       | #2-1  | 2018-05-05        | 2019-12-30      | 145 sqm    | \$6,525.00   | Yearly          |
| 9. Aburi-En             | A3       | #2-1  | 2018-05-05        | 2019-12-30      | 105 sqm    | \$3,990.00   | Monthly         |
| 10. Sephora             | D2       | #2-21 | 2018-05-05        | 2020-12-31      | 20 sqm     | \$1,100.00   | Fixed           |
| 11. Artisan Boulangerie | A3       | #1-2  | 2017-04-03        | 2020-12-31      | 172 sqm    | \$10,320.00  | Monthly         |
| 12. Adidas              | D3       | #0-19 | 2018-02-01        | 2019-10-31      | 1250 sqm   | \$60,000.00  | Fixed           |
| 13. Mothercare          | D2       | #1-41 | 2018-02-01        | 2019-12-30      | 20 sqm     | \$1,360.00   | Monthly         |
| 14. Chanel              | A3       | #3-3  | 2017-04-03        | 2019-10-15      | 55 sqm     | \$2,585.00   | Monthly         |
| 15. Brotzeit            | C1       | #2-6  | 2017-04-03        | 2020-12-31      | 119 sqm    | \$5,355.00   | Monthly         |
| 16. Awfully Chocolate   | B1       | #1-12 | 2018-05-15        | 2019-10-22      | 75 sqm     | \$4,500.00   | Yearly          |
| 17. Uniqlo              | B3       | #0-9  | 2017-04-03        | 2020-12-31      | 350 sqm    | \$21,350.00  | Yearly          |
| 18. RayBan              | D1       | #0-2  | 2018-02-01        | 2020-12-31      | 80 sqm     | \$5,200.00   | Yearly          |
| 19. HSBC                | C2       | #0-7  | 2019-05-14        | 2022-07-31      | 28 sqm     | \$1,708.00   | Fixed           |
| 20. ToysRus             | B2       | #2-41 | 2019-05-14        | 2019-10-31      | 1400 sqm   | \$85,400.00  | Fixed           |
| 21. Foodrepublic        | A1       | #1-12 | 2019-01-01        | 2020-12-31      | 1250 sqm   | \$56,250.00  | Monthly         |
| 22. Singtel             | B3       | #0-3  | 2018-02-01        | 2022-07-31      | 45 sqm     | \$2,925.00   | Fixed           |
| 23. Bata                | D3       | #1-22 | 2018-05-05        | 2019-11-29      | 90 sqm     | \$4,500.00   | Yearly          |
| 24. Marche              | A1       | #2-4  | 2019-02-01        | 2022-07-31      | 980 sqm    | \$32,340.00  | Yearly          |
| 25. Chulove Cafe        | D1       | #0-1  | 2019-05-14        | 2019-12-30      | 72 sqm     | \$3,672.00   | Monthly         |
| 26. Desigual            | B3       | #2-33 | 2018-03-17        | 2020-12-31      | 140 sqm    | \$4,620.00   | Monthly         |
| 27. MyRepublic          | B3       | #3-21 | 2017-01-01        | 2019-10-01      | 20 sqm     | \$1,360.00   | Monthly         |
| 28. Starbucks           | C1       | #0-8  | 2018-02-01        | 2019-12-30      | 40 sqm     | \$1,240.00   | Yearly          |
| 29. Penular             | D2       | #0-32 | 2019-05-14        | 2019-10-04      | 310 sqm    | \$17,360.00  | Fixed           |

## Automation

**Singtel**  
Exclusive Retailer

|                     |                                     |
|---------------------|-------------------------------------|
| B3                  | #0-3                                |
| Start of the lease: | 01 February 2018                    |
| End:                | 31 July 2022                        |
| Lot size            | Square meters: 45                   |
| Rental agreement:   | Total price (\$SGD per month): 2925 |
|                     | Frequency of revisions: Fixed       |

## Scenarios



## Lecture 5 TODAY



## SCENARIOS

### *"The Interlace:*

The 170,000m<sup>2</sup> development, which was completed and handed over to residents in late 2013, provides 1,040 generous residential units of varying sizes that are reasonably priced. The unusual geometry of the hexagonally stacked building blocks creates a dramatic spatial structure populated by a diverse array of activity areas.

The blocks are arranged on four main 'Superlevels' with three 'peaks' of 24 stories. Other Superlevel stacks range from 6-18 stories to form a stepped geometry, resembling the dramatic topography of a landscape more than a typical building. Multi-story openings allow light and air to weave into and through the landscape of the courtyards.

Pedestrian circulation is grouped and bundled according to the density of residents around each courtyard in a central 'connector'. A system of secondary footpaths brings residents from the connector to the private front doors of their homes."

**Source:** Büro Ole Scheeren



**A vertical village of living and social spaces integrated with the natural environment.**

**TYPE**  
Residential

**STATUS**  
Commission 2007, Completion 2013

**CLIENT**  
CapitaLand Singapore

**LOCATION**  
Singapore

**SITE**  
8 hectares at Alexandra Road /  
Depot Road

**SCALE**  
170,000 m<sup>2</sup>

**PROGRAM**  
1,040 Residences 144,000 m<sup>2</sup>,  
Clubhouse / Amenities 1,500 m<sup>2</sup>,  
Retail 500 m<sup>2</sup>, Ancillary / MEP  
24,000 m<sup>2</sup>, Basement Parking 2,600  
spaces





## SCENARIOS

### Investment proposal:

- Buy an *Interlace* apartment today for **\$3,000,000**.
- Rent it out for **\$5,700** per month for the next 5 years.
- Sell it off after **5 years**.

**Ad Quality** ★★★★★

Award-winning development ... ENJOY this rare town house !

**The Interlace (D04) Condominium, For Sale**

Property Type:  
Condo:  
Condominium

**SGD 3,000,000**  
(\$1,044 psf) *(Negotiable)*

Floor Area: 2,873 sqft/267 sqm      Tenure: 99 Years      Built Year: 2013

Furnished: No

DOES THIS INVESTMENT MAKE SENSE?

WHAT IS THE OVERALL EXPECTED RETURN IN DIFFERENT  
SCENARIOS?

- Future house prices
- Future interest rates

**The Interlace (D04) Condominium, For Rent**

*ICONIC CONDOMINIUM FOR RENT*

Blk 180 Depot Road, 109684  
Telok Blangah, Mount Faber, Harbourfront, Sentosa

**SGD 5,700**

**Ad Quality** ★★★★★

**3** **3**





## SCENARIOS

## Mortgage financing:

- Apply for mortgage financing with DBS.
- Current interest rates are quite low: **1.68% per year.**
- Ideally: use the rents to pay for the mortgage interest rate.

SOUNDS PROMISING, RIGHT?

LET'S SEE WHAT THE NUMBERS SAY...

### Fixed Rate Package

The complete assurance of a fixed rate for a number of years.



Year 1:

**1.68% p.a. Fixed**

Year 2:

**1.68% p.a. Fixed**

Year 3:

**1.68% p.a. Fixed**

Thereafter:

**FHR9 + 1.55% p.a.**





## SCENARIOS

# 1 Keying in the assumptions

We start by calculating basic statistics, such as:

- How much should we borrow, given that in Singapore the government imposes a minimum downpayment of 20% of the property's value?
- How much is the total yearly rent that we can expect to receive?
- How much interest do we expect to pay every year?

Assumptions  
(indicated in blue font)

Case Study  
THE INTERLACE

|                                    |            |               |
|------------------------------------|------------|---------------|
| Property value                     | SGD        | \$3,000,000   |
| Mortgage downpayment               | %          | 20%           |
|                                    | SGD        | \$600,000     |
| Mortgage amount                    | SGD        | (\$2,400,000) |
| Interest rate                      | % per year | 1.68%         |
| Monthly rent                       | SGD        | \$5,700       |
| Yearly rent                        | SGD        | \$68,400      |
| Yearly payment of interest         | SGD        | (\$40,320)    |
| Yearly growth rate in house prices | %          | 3.00%         |

**Note:** For simplicity, we assume that the loan has zero amortisation in the first five years, i.e. the borrower only pays interest and does not repay any principal. At the end of the five years, he/she has to repay the loan in full.





## SCENARIOS

## 2 Calculating net cash flows and the IRR

We now compute the yearly cash flows:

Income (i.e. the **rent** received from the tenant)

- Expenses (i.e. the **interest** paid to the bank).

=

Net cash flow

|                                      | Purchase of property | Rental period |            |            |            |            |            | Sale of property |
|--------------------------------------|----------------------|---------------|------------|------------|------------|------------|------------|------------------|
|                                      |                      | 0             | 1          | 2          | 3          | 4          | 5          |                  |
| Income                               | SGD                  |               | \$68,400   | \$68,400   | \$68,400   | \$68,400   | \$68,400   | \$3,477,822      |
| Expense                              | SGD                  | (\$600,000)   | (\$40,320) | (\$40,320) | (\$40,320) | (\$40,320) | (\$40,320) | (\$2,400,000)    |
| Net cash flow                        | SGD                  | (\$600,000)   | \$28,080   | \$28,080   | \$28,080   | \$28,080   | \$28,080   | \$1,077,822      |
| <b>Internal rate of return (IRR)</b> |                      |               |            |            |            |            |            |                  |
| <b>%</b>                             |                      |               |            |            |            |            |            |                  |
| <b>13.6%</b>                         |                      |               |            |            |            |            |            |                  |

**Note:** We calculate the Internal Rate of Return using the **IRR** formula in Excel.





## S C E N A R I O S

### 3 Running a scenario analysis

- How sensitive is our investment performance to the **price appreciation** that we expect to see in the market?

**Note:** After running the scenario analysis, we need to make sure that the house price growth rate is set back to its original value of 3%:

```
Worksheets(1).Range("D18").Value = 0.03
```

```
Sub RunScenarios1()
```

```
For i = 1 To 11
```

```
    Worksheets(1).Range("D18").Value = Worksheets(2).Range("D3").Offset(i, 0).Value
```

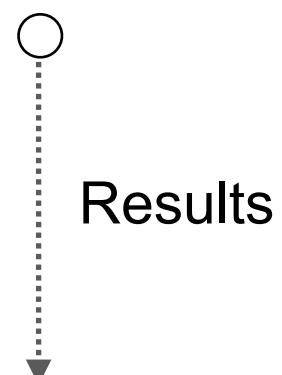
```
    Worksheets(2).Range("H3").Offset(i, 0).Value = Worksheets(1).Range("D27").Value
```

```
Next
```

```
' Note: After running through the scenarios, we need to set the house price growth
' rate to its initial value of 3%
```

```
Worksheets(1).Range("D18").Value = 0.03
```

```
End Sub
```



| Yearly growth rate in house prices | % | Internal rate of return (IRR) | % |
|------------------------------------|---|-------------------------------|---|
| -4.0%                              |   | -24.5%                        |   |
| -3.0%                              |   | -12.3%                        |   |
| -2.0%                              |   | -5.4%                         |   |
| -1.0%                              |   | -0.2%                         |   |
| 0.0%                               |   | 4.0%                          |   |
| 1.0%                               |   | 7.6%                          |   |
| 2.0%                               |   | 10.7%                         |   |
| 3.0%                               |   | 13.6%                         |   |
| 4.0%                               |   | 16.2%                         |   |
| 5.0%                               |   | 18.6%                         |   |
| 6.0%                               |   | 20.9%                         |   |

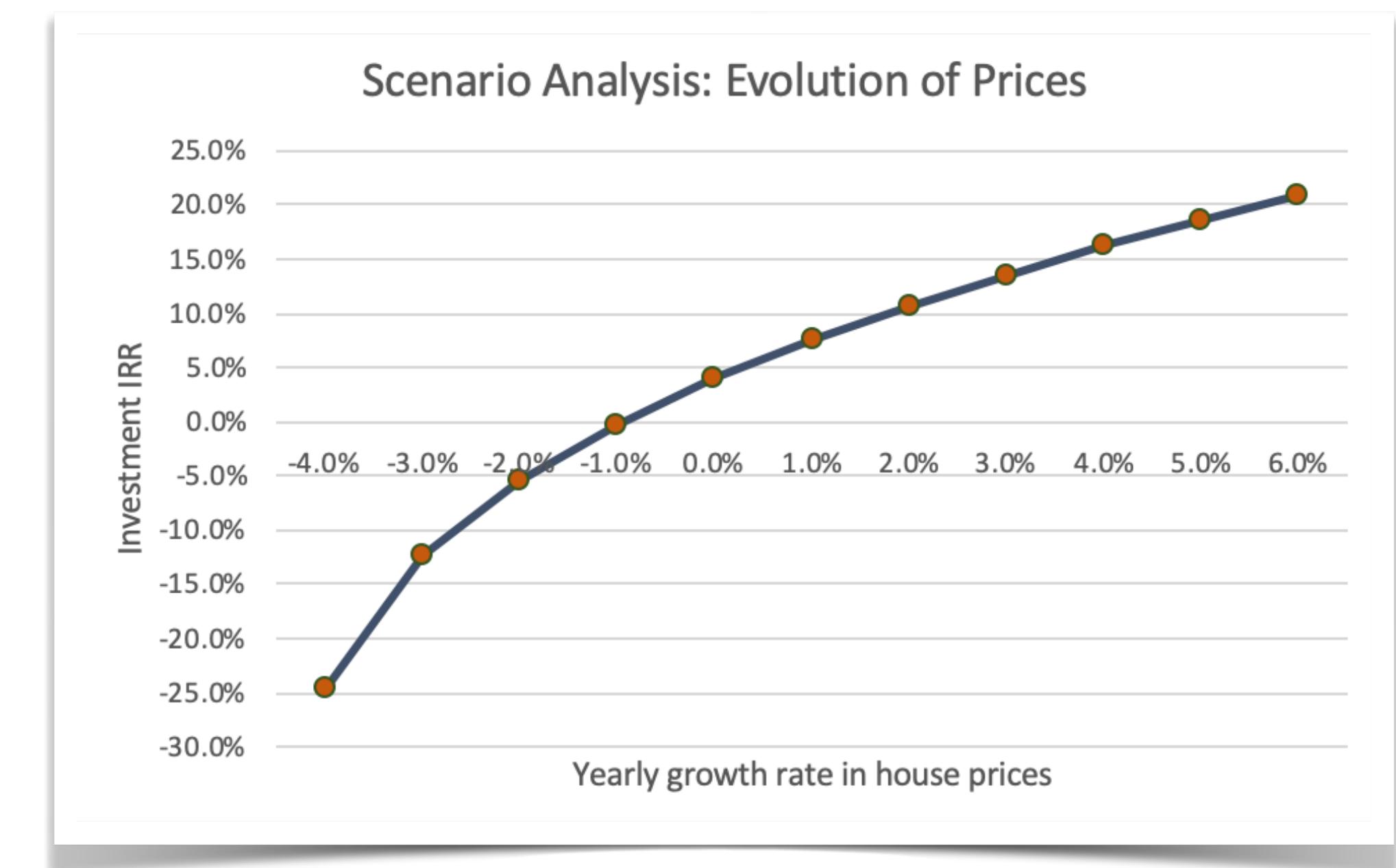




### 3 Running a scenario analysis

- How sensitive is our investment performance to the **price appreciation** that we expect to see in the market?

**Results**



Is this a good figure?

What do we learn from it?



## S C E N A R I O S

3

## Running a scenario analysis

- How sensitive is our investment performance to the **interest rate** that we pay on the mortgage contract?

**Note:** After running the scenario analysis, we need to make sure that the mortgage interest rate is set back to its original value of 1.68%:

```
Worksheets(1).Range("D11").Value = 0.0168
```

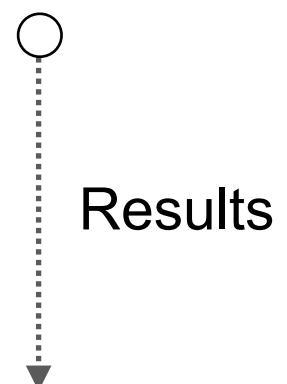
```
Sub RunScenarios2()
```

```
For i = 1 To 17
    Worksheets(1).Range("D11").Value = Worksheets(2).Range("D17").Offset(i, 0).Value
    Worksheets(2).Range("H17").Offset(i, 0).Value = Worksheets(1).Range("D27").Value
Next
```

```
' Note: After running through the scenarios, we need to set the interest rate to its
' initial value of 1.68%
```

```
Worksheets(1).Range("D11").Value = 0.0168
```

```
End Sub
```



| Interest rate | %     | Internal rate of return (IRR) | %     |
|---------------|-------|-------------------------------|-------|
| 0.00%         | 0.00% | 18.5%                         | 18.5% |
| 0.25%         | 0.25% | 17.8%                         | 17.8% |
| 0.50%         | 0.50% | 17.0%                         | 17.0% |
| 0.75%         | 0.75% | 16.3%                         | 16.3% |
| 1.00%         | 1.00% | 15.5%                         | 15.5% |
| 1.25%         | 1.25% | 14.8%                         | 14.8% |
| 1.50%         | 1.50% | 14.1%                         | 14.1% |
| 1.75%         | 1.75% | 13.4%                         | 13.4% |
| 2.00%         | 2.00% | 12.6%                         | 12.6% |
| 2.25%         | 2.25% | 11.9%                         | 11.9% |
| 2.50%         | 2.50% | 11.2%                         | 11.2% |
| 2.75%         | 2.75% | 10.5%                         | 10.5% |
| 3.00%         | 3.00% | 9.8%                          | 9.8%  |
| 3.25%         | 3.25% | 9.2%                          | 9.2%  |
| 3.50%         | 3.50% | 8.5%                          | 8.5%  |
| 3.75%         | 3.75% | 7.8%                          | 7.8%  |
| 4.00%         | 4.00% | 7.1%                          | 7.1%  |

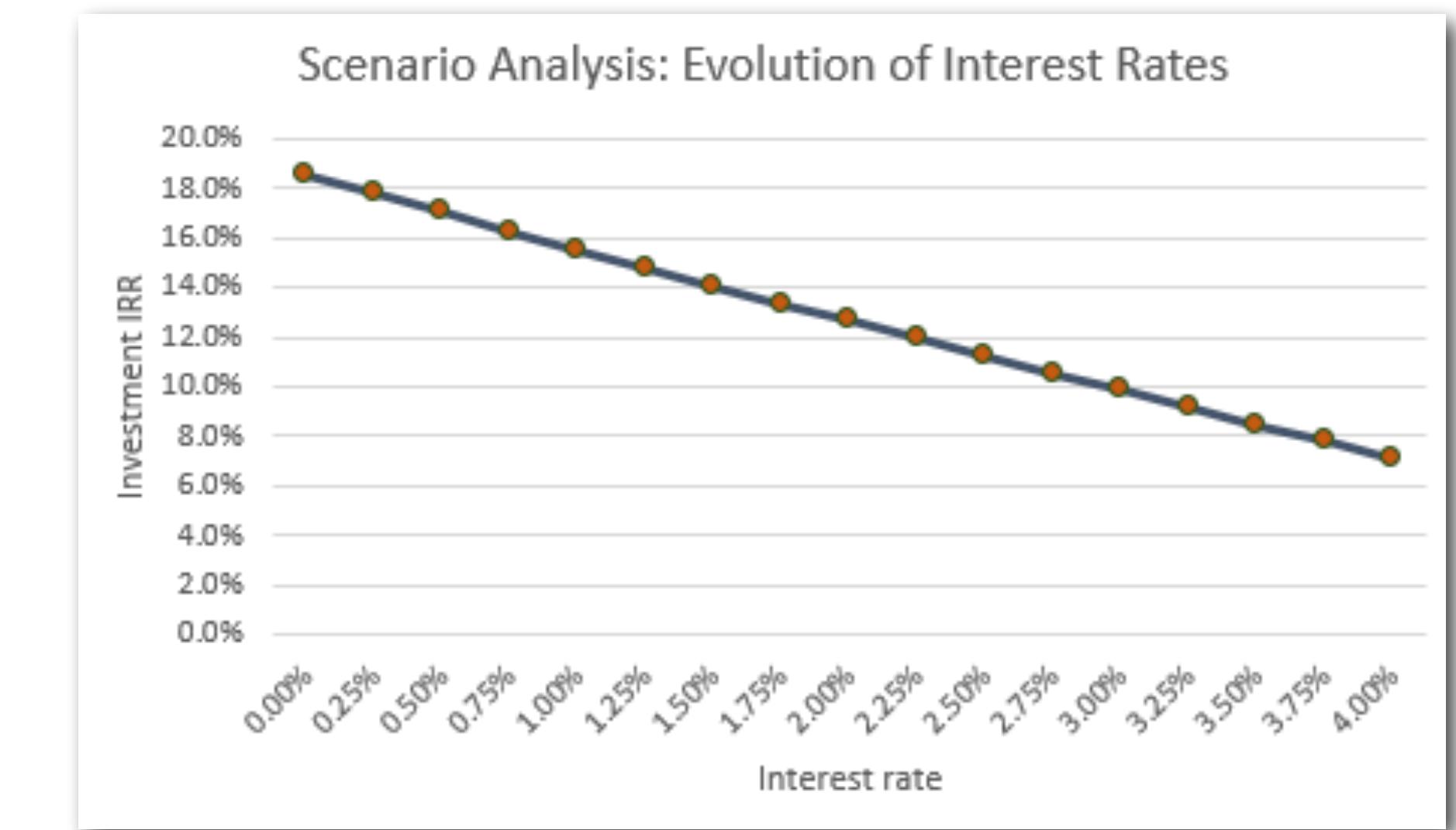




S C E N A R I O S

### 3 Running a **scenario** analysis

- How sensitive is our investment performance to the **interest rate** that we pay on the mortgage contract?

**Results**

Is this a good figure?

What do we learn from it?



## SCENARIOS

## 4 Adding a button

Finally, let's make our scenario analysis easier to run.

A **button** can be linked to any **Sub** that we have written.

(Select: 'Assign Macro')

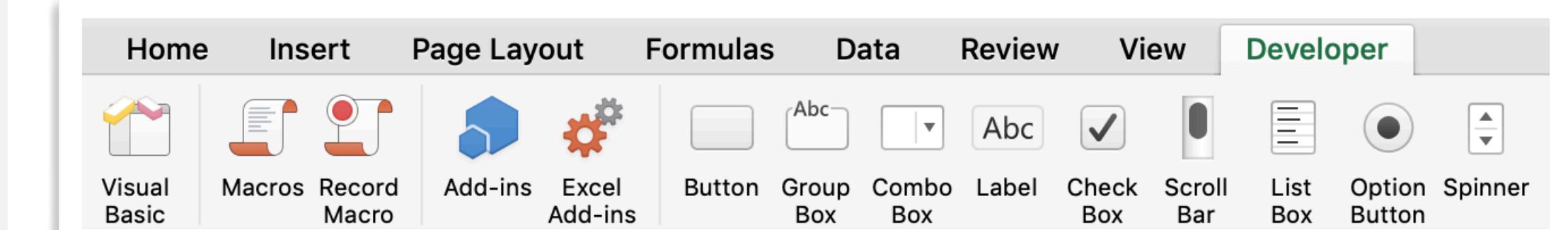
A simple click of the button will run that **Sub**.



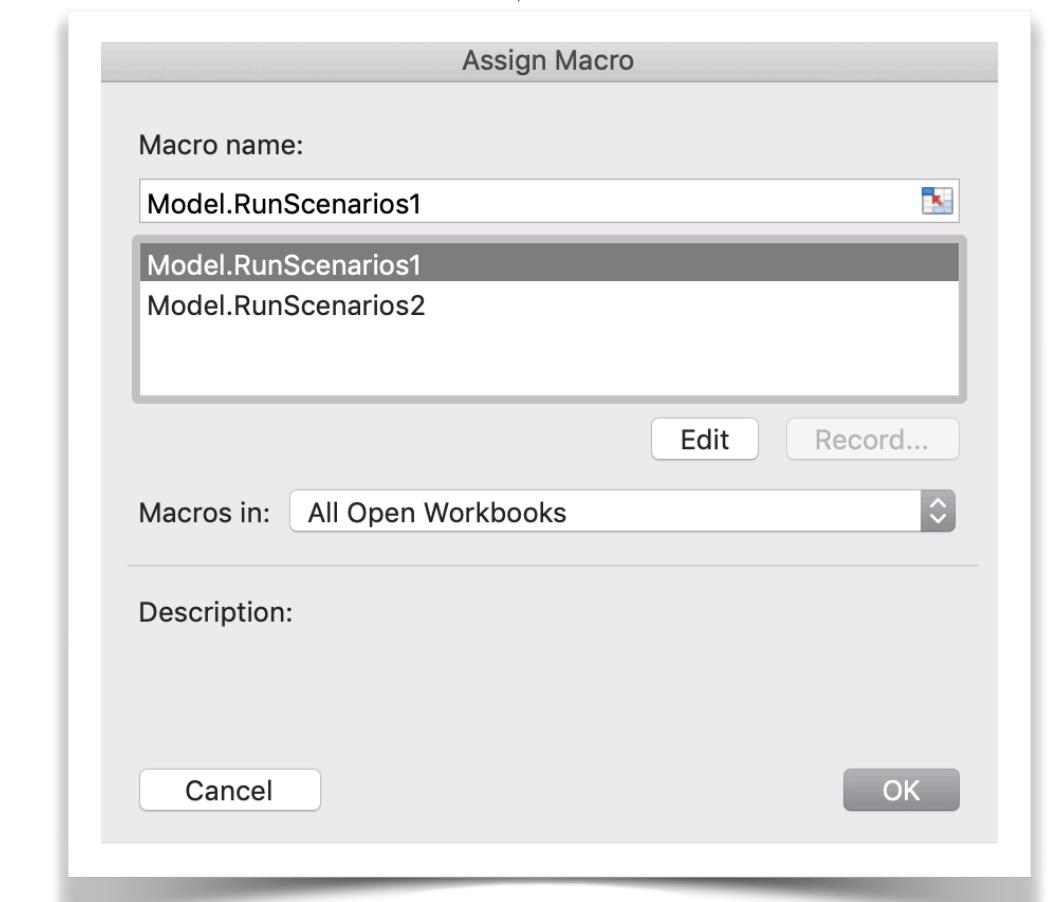
J O B   D O N E !



Inserting a button:



Selecting the Sub that the button should link to:



Renaming and resizing the button:





## SCENARIOS

5

## Running random scenarios

The *Rnd()* function:

- Returns a random number, uniformly distributed between 0 and 1.
- Returns different numbers every time it is being run.

```
Sub RunScenarios3()

    low = Range("E2").Value
    high = Range("E3").Value

    For i = 1 To 2000

        Worksheets(3).Range("E5").Offset(i, 0).Value = (high - low) * Rnd() + low

        Worksheets(1).Range("D11").Value = Worksheets(3).Range("E5").Offset(i, 0).Value

        Worksheets(3).Range("J5").Offset(i, 0).Value = Worksheets(1).Range("D27").Value

    Next

    ' Note: After running through the scenarios, we need to set the interest rate to its initial value of 1.68%
    Worksheets(1).Range("D11").Value = 0.0168

    ' Build simulation diagnostics
    Worksheets(3).Range("J2").Formula = "=MIN(J6:J2006)"
    Worksheets(3).Range("J3").Formula = "=AVERAGE(J6:J2006)"
    Worksheets(3).Range("J4").Formula = "=MAX(J6:J2006)"

End Sub
```

**"Monte Carlo"** simulation =  
Randomly generated scenarios, which mirror  
the actual uncertainty of real life events



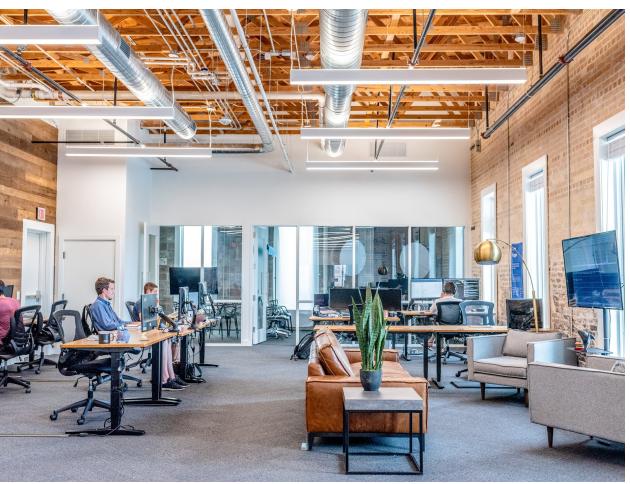
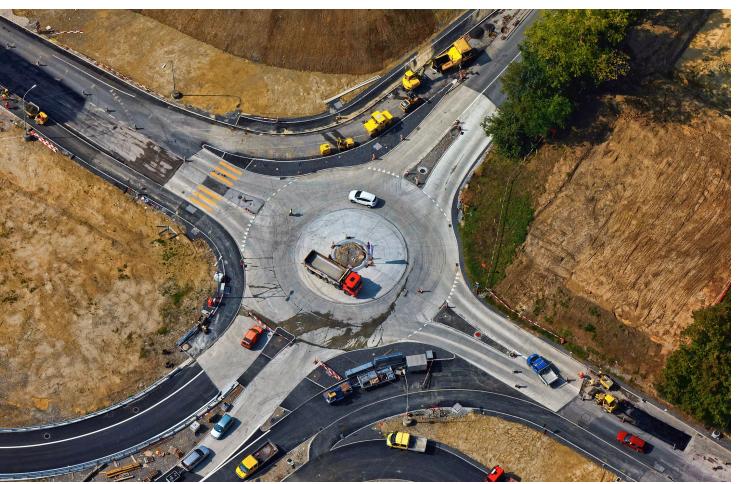
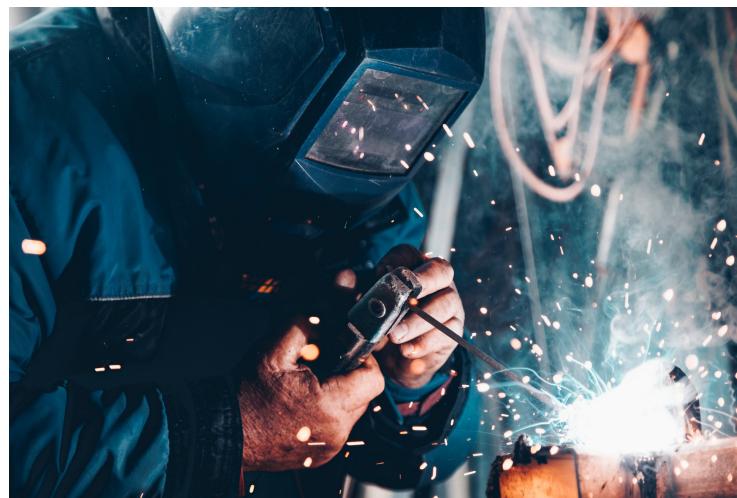
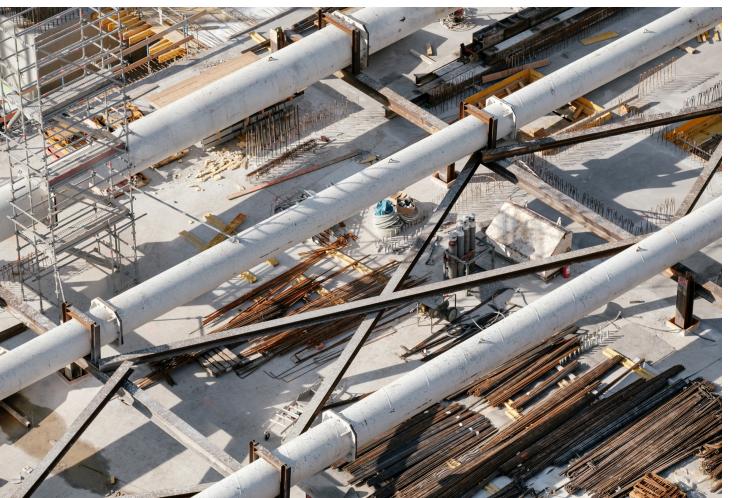
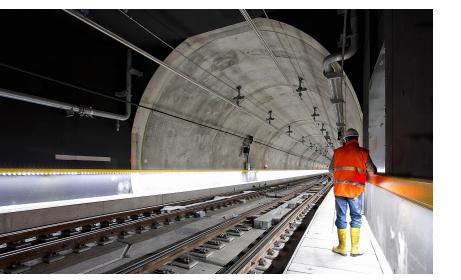
| Internal rate of return (IRR) | %       | Min   | 12.7% |
|-------------------------------|---------|-------|-------|
|                               | Average | 15.6% |       |
|                               | Max     | 18.5% |       |



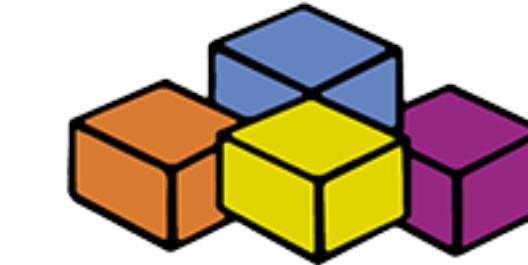
## SCENARIOS

### Other examples of similar problems:

- ‘*What If*’ analysis of building performance management.
- Sensitivity analysis of financial performance.
- Robustness checks.
- Simulations.
- Assessment of relative benefit of alternative options.
- Illustration of input-output relationships.
- Understanding implications of extreme scenarios.
- Implications of different assumptions on the pricing and valuation of real assets.
- Incorporating macroeconomic risks into property valuation modeling.



# SUMMARY



Microsoft  
**VisualBasic**<sup>®</sup>  
for Applications



We have now arrived at the end of **Part 1** of this module.

We have started by introducing the building blocks of computer thinking and programming: conditional statements, repeated iterations, functions and objects. We have then applied these concepts to solve two problems that routinely occur in real estate business environments: (1) **automating** a data process, and (2) running a **scenario** analysis.

Of course, there are many more possible applications, but I wanted to restrict our focus to these two, for which Visual Basic is **the best** solution.

For all other types of applications, and especially those involving *data* and *data analytics*, we continue our journey with Python, in **Part 2** of this module.

grazie 谢谢 ขอบคุณ  
merci Σας ευχαριστώ tack bedankt  
tack Спасибо ດັນຍວາດ ありがとう  
gracias thank you terima kasih  
teşekkür ederim شکرًا danke kiitos 고마워요  
danke köszönjük