FINANCIALMODELING INSTITUTE

LEVEL 1:
ADVANCED FINANCIAL MODELER (AFM)

AFM BODY OF KNOWLEDGE

Introduction

This Body of Knowledge is a reference document to help prospective candidates prepare for the Advanced Financial Modeler (AFM) exam.

The AFM exam is the first of three levels of modeling certifications offered by the Financial Modeling Institute.

For purposes of the AFM exam and this Body of Knowledge, a financial model is considered to be a spreadsheet forecast model of a company.

This document contains important information on model design, structure, technical skills and components that candidates will be tested on during the exam.

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I. Financial Modeling Best Practices

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1. Modeling as a Discipline

- Financial Modeling is a unique professional discipline
- A financial model needs to serve as a powerful communication tool to clearly and effectively tell the story of a company to management and stakeholders
- A financial model is a critical decision-making tool that allows users to make accurate and informed financial decisions about a company
- A builder of financial models requires skills in accounting, finance, spreadsheets and overall business knowledge in order to effectively forecast a company's financial statements into the future

2. Model Attributes

- To achieve the goals set out above, a model needs to be developed with the following attributes:
  a. **Dynamic:** changes to assumptions properly flow through the model
  b. **Flexible:** modular in order to facilitate easy expansion and changes to the model
  c. **Intuitive:** layout/flow mirrors how people think about the business
  d. **Transparent:** easy to follow with no giant formulas or hidden sections
  e. **Printable:** in a clear and easy-to-read format on paper
  f. **Transferable:** built by one person but usable by many
- When a model achieves the criteria above, it creates tremendous credibility for the builder and inspires confidence with the reader
- A well-designed model needs to work in two ways:
  - Electronically – a model must be simple to review / audit / manipulate in a spreadsheet to ensure it can be used as a tool in the decision-making process
  - In printed format – many senior executives and other decision makers prefer to review financial analysis on paper or as PDF documents (rather than reviewing a spreadsheet)
- This Body of Knowledge document has been developed to enable model builders to create models of the highest caliber that achieve the conditions set out above
- Successfully completing the AFM exam will require knowledge and understanding of the concepts in this document

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3. Model Planning

- It is critical to properly plan and design a model before it can be built
  - Whenever a model becomes filled with errors, it is often because the modeler did not properly devise a model plan. A model built without forethought is often chaotic and requires many additions on a weak foundation.
- A model builder needs to first understand how a business operates, which requires:
  - Reviewing the historical financial statements of the company (including the Management Discussion & Analysis and Notes to the Financial Statements)
  - Learning about the industry in which the company operates (i.e. reading industry journals and equity research reports)
  - Deciding on the key drivers / critical success factors for the industry / company
  - Creating a list of questions to help identify and gather all the assumptions that need to be made in the model
- Understand the purpose of the model (i.e. is the model to be used for valuation? credit assessment? project evaluation?)
- Identify the required schedules and components to be included in the model
  - Schedules should be planned for all specific calculations needed in the model, such as revenues, costs, depreciation, working capital, etc…
- As part of the planning process, the model builder should also be able to answer the following questions:
  i. Can a reader of the model understand the operations of the company?
  ii. Have the operations been modeled correctly?
  iii. What is the right level of detail required in the model?
  iv. Have the assumptions been challenged and vetted?
  v. Which assumptions are key drivers to be tested as scenarios?
  vi. Is there enough historical detail to validate the required amount of forecast detail?
  vii. What is the important output that the users want to know?
  viii. What metric is used to measure results?
  ix. How many time periods should be included in the forecast? Why?
  x. What's the appropriate periodicity for the model (e.g. monthly, quarterly, annual)?
  xi. What is the most logical order to present the data?

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4. Design / Presentation

- The design of a model is critical to ensure that it conveys information clearly and professionally
- Some companies will have specific Brand Standards that should be incorporated into models. These can include fonts, colours, logos and other
    - We recommend that models incorporate a limited use of bold formatting, even if present in brand standards, in order to maintain the speed and performance of a model
- Since models are frequently printed in mono-colour, we recommend that candidates take care in altering the colour of any fonts. When in doubt, we recommend a black, bright blue (0,0,255), and dark red (XXX)
    - For more information on the application of this suggestion, please see Section 6. b. in Model Construction Tips
- The following are some general design recommendations:

a. Design Tips

i. Include a cover page

ii. If the model is large, include a Table of Contents

iii. Repeat the company name (or project name) at the top of every page

iv. Include a subtitle on every page that describes the purpose of the particular page

v. Ensure that every row and cell is labeled clearly

vi. Include a column that describes the unit of measurement for each row

vii. Include a section for model checks towards the front of the model so that the user knows if there are any problems within the model (i.e. is the balance sheet balanced, are any credit ratios being tripped, etc…)

b. Headers / Footers

i. Include the file path on every page (typically the bottom left or right corner)

ii. Include page numbers on every page (typically the bottom centre)

iii. Include a date and time stamp on every page (typically the bottom left or right corner)

iv. Incorporate a Scenario Tag on every page that displays the case being run – this is simply a label that explains to the reader which set of assumptions are being run

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5. Tab Structure

- Models can be designed in either a **vertical** or **horizontal** manner. For the purposes of the AFM exam, either approach is acceptable.
  - A vertical model refers to a model in which most of the schedules and financial statements are built on the same tab within the Excel file
  - A horizontal model refers to a model in which most of the schedules and financial statements are built on different tabs within the Excel file
- In addition, the Publicly Available Learning Materials on the FMI website contains a sample vertical and a sample horizontal model.

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- **The following is the recommended tab structure for a vertical financial model:**
  - **a. Cover**
    - Sets the tone for the model and can hide confidential information
    - Can include key information such as: client name, project name, date, creator
  - **b. Summary**
    - Executive summary that summarizes the key metrics required to make a decision
    - There may be more than one table on the summary tab depending on the nature and complexity of the model
  - **c. Assumptions**
    - All assumptions are presented on one tab in the model (multiple assumptions pages can be arranged vertically on one tab, however, some models may require a few tabs with assumptions – if that's the case, the assumptions tabs should all be beside each other towards the front of the model)
    - Makes it easy to update the model and to review the model on paper
  - **d. Scenarios**
    - Additional assumptions that represent the key drivers of the business
    - Key drivers are inputs that have a material impact on outputs and are difficult to forecast and control
    - These assumptions should be created with multiple cases and a switch to change
      the case being run
  - **e. Model**
    - Typically, the longest sheet within the model
    - Includes all the financial statements and schedules
    - For models with multiple time periods (e.g. quarters and years), there may be two model sheets – one for the quarterly forecasts and one for the annual forecasts
    - For a large complex company, it may be advisable to create additional tabs (e.g. Operation A, Operation B, etc.) to provide greater clarity
  - **f. Outputs**
    - Should include all the output calculations in the model, such as ratios and valuation calculations

- It is recommended that these tabs are organized in the same order within the Excel spreadsheet (i.e. "Cover" is the first tab, all the remaining tabs are found to the right)

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- **The following is the recommended tab structure for a horizontal financial model:**

a. Cover

- Sets the tone for the model and can hide confidential information
- Can include key information such as: client name, project name, date, creator

b. Summary

- Executive summary that summarizes the key metrics required to make a decision
- There may be more than one summary tab depending on the nature and complexity of the model

c. Assumptions

- All assumptions are presented on one tab in the model (some models may require a few tabs with assumptions – if that's the case, the assumptions tabs should all be beside each other towards the front of the model)
- Makes it easy to update the model and to review the model in printed format

d. Scenarios

- Additional assumptions that represent the key drivers of the business
- Key drivers are inputs that have a material impact on outputs and are difficult to forecast and control
- These assumptions should be created with multiple cases and a switch to change
  the case being run

e. Schedules Tabs

- Each of the supporting schedules is typically built on its own tab
- Typical schedules in most financial models include:
    - Revenue Schedule
    - Operating Cost Schedule
    - Capex / Depreciation Schedule
    - Income Tax Schedule
    - Working Capital Schedule
    - Debt Schedule
    - Equity Schedule

f. Financial Statements Tabs

- In a horizontal model, each of the financial statements can be built on separate tabs, but they can also be created vertically on one tab

g. Outputs Tabs

- Should include all the output calculations in the model, such as ratios and valuation calculations

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6. Model Construction Tips

- The following are some tips to construct a model effectively:

a. Structural Tips

i. Use a manageable number of worksheets in the model (5 to 10 is recommended)
ii. Keep all assumptions up front
iii. Only type the company name once (every other instance of the company name should link back to a prior instance within the model)
iv. Never enter the same variable twice within the model (a second instance should be linked back to the actual input cell)
v. Never hardcode values within formulas (i.e. =A5 + B5 + 29.832) – the 29.832 is a hardcoded value and should have been entered into its own cell and referenced in the formula
vi. Do not insert blank columns in between years (for extra space, make the columns wider / to add calculated growth rates, these should go on a different row)
vii. Within each sheet, each time period must always be in the same column
viii. Use circularity sparingly, and only if it's necessary and you have an excellent grasp of how to build, manage and de-bug circular references (see section on the following page)
ix. Minimize or avoid the use of macros unless absolutely necessary – one common usage of macros in financial models is to create summary pages that populate the answers for multiple cases simultaneously – on the AFM exam, participants are not required to incorporate any macros
x. Never delete a row or column until you have checked to see whether it is being used in other formulas

b. Formatting Tips

i. Font colours – use one colour for inputs and a second colour for formulas (a common convention is to use **blue** for inputs and **black** for formulas or links within the same sheet - a third dark colour can be used to signify cells that are linked to the assumptions tabs or for another reason as stated by the modeler)
ii. Think about how the model will be printed and make sure the various schedules are created in page-sized units
iii. Review a model on paper before delivering it to colleagues or clients
iv. Format the model as you build it – don't wait until the very end to do all the formatting
v. Use "Model Checks" and flags to indicate when there are problems within the model

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c. Formula Tips

i. Don't build any large formulas directly on the financial statements – the statements should largely contain links to schedules
ii. All formulas and calculations should be built on the various schedules
iii. The formulas and calculations should be as short and simple as possible
iv. To keep the formulas efficient, repeat and link all data from the assumptions onto the respective schedules
v. Avoid building large formulas that include multiple cell references to different worksheets – instead, break these formulas apart and put the cell references in separate, clearly labeled cells on the same sheet as the calculation

d. Circularity in Financial Models

- Circular references are amongst the most contentious issues in the world of financial modeling
- Views on the appropriateness of circularity vary by region, by sector and by company, so be sure to utilize the approach in the organization where you work
- Regardless of whether your organization allows the use of circularity, you should only use circular references if you fully understand the rationale, the mechanics and the risks of incorporating a circular reference within a model
- On the AFM exam, candidates can choose whether or not to include circularity
- Circularity is caused in financial models when a cell references itself, or when multiple cells reference each other (i.e. A1 = A2, A2 = A3, A3 = A1)
- In a financial model of a company, the most common instance of circularity is in the calculation of interest expense
- One way to calculate the forecast interest expense on a piece of debt is as follows:

  = Interest Rate x Average(Beginning Debt Balance, Ending Debt Balance)
- This calculation assumes that changes in a piece of debt happen evenly throughout the period
- However, for some pieces of debt, the ending debt balance is a function of the company's cash flow during the period, and the cash flow during the period is only known once the interest expense is known
- Hence, for these pieces of debt
  I. You do not know the ending debt balance until you know interest expense during the period; however,
  II. You do not know the interest expense during the period until you know the ending debt balance (if you use the Average formula above)
- If your organization is comfortable with circularity, you will need to enable Excel's Iterative Calculation setting (in the Options settings)

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- If your organization is not comfortable with circularity, the most common way to avoid it is by calculating interest expense as: Interest Rate x Beginning Debt Balance

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II. Excel Skills

1. Excel Tools

- Excel is the dominant spreadsheet software used worldwide and therefore used on the exam
- It is important to be able to work quickly and efficiently with Excel in order to build powerful financial models
- Candidates should be comfortable with the following topics:

a. Formatting skills including custom formatting

- Proper formatting provides several benefits to the builder and user of a financial model:
  - Well-formatted models are easier to read and follow
  - An attractive model will be taken more seriously since the reader will assume that time and care have been used in its creation
  - The reader will always have context for the presented analysis (e.g. units being used, item descriptions, nature of the analysis) so that they remain focused on the flow of the analysis without interrupting with questions
- Formatting should be done as the model is being built – "format as you go"
  - The builder will never understand the context of a number better than when it has been calculated or added to the model so formatting at that moment saves time
- Formatting can be viewed as incorporating four distinct skills:
  - Changing output appearance such as bolding, number format and font colour
  - Create custom formats that include special characters, words and unique number formats
    - CTRL + 1 (on a PC), then select "Custom" on the Number tab of the Format Cells menu
  - Copying formatting quickly and efficiently using paste special or a shortcut sequence such as ALT + H + V + R
  - Building descriptive labels, titles and footnotes that use formulas instead of static text entry that require maintenance (e.g. CONCATENATE, TEXT)
  - Conditional Formatting (see section F on next page)

b. Lookup Functions

- All financial models require the linking of data or calculations in one part of a model to subsequent formulas in different cells
- There are a variety of lookup functions that facilitate these connections and modelers need to be proficient in the use of them in order to build elegant and flexible models

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c. Absolute References

- The ability to create formulas with absolute references is extremely important when manipulating data and building financial models
- By default, Excel uses relative referencing
- Absolute references allow you to "lock" a reference to a particular cell, row or column by inserting dollar signs in front of the row reference, the column reference or both

d. Paste Special

- Allows you to paste specific elements from one cell to another
- Can be used to paste Formulas, Values, Formats, or Mathematical Operations
- Can also be used to transpose text or data

e. IF Statements

- The IF function is the most used (and abused) function in Excel due to its flexibility and most modeller's familiarity with IF, THEN, ELSE logic.
- IF functions can also be nested (put inside another successive IF statement) multiple times, allowing a modeller to organically "think through" a data problem rather than implement good design.
- Having a broad knowledge of spreadsheet design and other Excel functions enables the builder to avoid over-using nested IF functions.

f. Conditional Formatting

- This feature applies formatting to cells that meet pre-specified criteria
    - Conditional Formatting makes it easy to highlight interesting cells or ranges of cells and emphasize unusual values
    - If you have more than one rule, the first rule will take priority over the second rule, so it's important to enter the rules in the appropriate order
    - Conditional formatting only allows you to change font style, underline, color, and strike-through as well as borders and shading. You cannot change the font or the font size.
- Excel provides a number of built-in formatting rules which allow a user to format based on predefined tests (such as top or bottom ranked values, etc.)
- Using a formula to apply conditional formatting gives additional flexibility

g. Forms & Drop-down Boxes

- The Choose function is a simple and clean way of creating scenarios rather than using an IF Statement
- To create a more user-friendly interface on a scenario switch, a pull down menu can be used to control the CHOOSE function

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- A pull down menu restricts the values that can be entered into the switch cell, thereby reducing the possibility of causing an error
- It is also visible even if the cell is not active and also shows up on printed copies of the model (unlike other techniques such as Data Validation)

h. Printing

- Set up the model in print-size pages – if the model is not well designed, it won't be easy to print
  - Approximately 8 to 10 columns of numbers with row labels
  - Approximately 35 to 50 rows with page titles

- File – Page Setup Menu – Page tab:
  - Set to Landscape
  - Scaling should be 85% to 95%

- File – Page Setup Menu – Margins tab:
  - Minimize the margins: .25" to .4"
  - Click the option to centre on page horizontally

- File – Page Setup Menu – Header/Footer tab:
  - Click Custom Footer and click on the [Page] and [Pages] buttons
  - Can also use the date, time, and file path buttons

- File – Page Setup Menu – Sheet tab:
  - This is the key technique to maintain consistent print ranges that do not have to constantly be reset. In the Sheet box, enter each page range separately, separated by a comma
  - Each page on the model should be separated by at least one blank row

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III. Keyboard Shortcuts

1. Shortcuts

- Every advanced Excel user needs to understand the importance of using keyboard shortcuts
  - It is the quickest way to work in Excel, saving significant amounts of time by not reaching for and using the mouse
  - It is the most efficient and accurate way to work in Excel, maximizing productivity
- There are many keyboard shortcuts in Excel, and they vary regionally and by operating system
- Model builders should be comfortable with the following categories of shortcuts:
  a. Navigating shortcuts
  b. Selecting Cells
  c. Function Keys
  d. Function Shortcuts
  e. Formatting Shortcuts
  f. Editing Shortcuts
  g. ALT Navigation Key Shortcuts (on a PC)

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IV. Scenario Analysis

1. Scenario Analysis

- Flexibility in models is critical, as stakeholders typically like to know what the impacts of changing key drivers would do to the overall business under various scenarios (ie. Base Case, Best Case, Worst Case…)
    - Key drivers are assumptions that are difficult to forecast, hard to control, and they materially affect the business. These can include:
        - Sales Price
        - Sale Volume Growth
        - Cost Inflation
        - Currency Exchange Rates
        - Input Costs
    - An effective model should be able to switch between different operating cases, or scenarios, and these assumptions should dynamically flow through the model and ultimately through to the financial statements
- Scenario analysis assists to bookend business decisions. By considering best and worst case scenarios, individuals are provided a clearer picture of possibilities and are therefore able to consider implications.
- An effective model will have at least three different scenario cases:

  1 = Base Case

  2 = Upside Case

  3 = Downside Case
- It is important to note that having a high number of scenario variables is not ideal since too many variables complicate the analysis and require substantial work to update and maintain
- Scenarios should be reserved only for key driver assumptions that materially affect the business

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2. Scenario Analysis Skills

- When financial modelers need to choose from a number of items [in this case 1, 2, and 3], the IF statement is typically the go to function to perform the task
    - However, there are simpler and cleaner ways to do this:
        - CHOOSE function
        - INDEX function
        - OFFSET function
- Instead of manually typing in the numbers “1”, “2”, or “3” for the three different operating cases, or scenarios, a Combo Box can be inserted
    - This is a more user friendly way to toggle between scenarios and will allow the model user to effectively choose the case they want utilizing a drop-down that states the name of the case (the number associated with the case is hidden behind the combo box)

3. Saving a Model

- Version control is extremely important to keep track of the latest version of the model
    i. The only criterion that should be used when saving a new version of a model is “time”
    ii. A proper naming convention is [Company Name] [Date].xls
    iii. Dates should be structured in the format of Year/Month/Day so that models can be viewed in true chronological order
    iv. Never use “Save As” to re-save a version that is running a different operating case – all cases should be captured using Scenarios in the same model
- Save using “Password to Modify” – provides read-only access to avoid situations where another user inadvertently introduces an error into the model
- Always save your work regularly

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V. Model Components

1. Financial Statements

- It is crucial for model builders to have a solid grasp of accounting fundamentals in order to understand the linkages between the various numbers on the financial statements

- A financial model of a company will typically contain the following financial statements
    a. Statement of Earnings (Income Statement)
    b. Statement of Cash Flows (Cash Flow Statement)
    c. Statement of Financial Position (Balance Sheet)

- A financial model of a company may also include other statements:
    a. Statement of Comprehensive Income
    b. Statement of Changes in Shareholder's Equity
    c. Sector-specific statements (i.e. for banks)

- It is critical to understand the framework of each statement and connectivity to other sheets within the workbook

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2. Model Schedules

- For a financial model of a company, the model should also include a number of schedules to calculate the values that will be required on the financial statements
- The most common schedules to include in a model are:

a. Operating Schedules

i. Revenue Schedule
- Calculate based on (i) number of units sold and (ii) selling price
- Ensure business is not producing at greater than operating capacity

ii. Operating Cost Schedule
- Calculate both the (i) variable and (ii) fixed costs
- Both types of costs should be shown on a per unit and aggregate basis

iii. Capex / Depreciation Schedule
- Ensure assets are not being over depreciated

iv. Income Tax Schedule
- Show the differences between accounting and taxable income
- Reflect any unique industry and/or company tax issues
- Reflect any timing differences between accounting and government earnings

v. Working Capital Schedule
- Calculate based on (i) income statement items (e.g. Revenue, COGS) and (ii) number of days (or turns)

b. Capital Structure Schedules

i. Debt Schedule
- Build a separate schedule for each piece of debt
- Calculate interest expense for each piece of debt

ii. Equity Schedule
- Build a separate schedule for each of piece of equity (including retained earnings)
- Calculate dividends (if any) for common and preferred stock

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About the FMI

We are dedicated to excellence in Financial Modeling and offer globally recognized certifications.