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| **INFOSYS330 2018 – Assignment 2**  20% of final grade  **Due Wednesday 10th October 2018 23:59pm on Canvas** |  |

# No late submissions will be accepted without prior permission.

# Please Note:

* Style and formatting, quality of content, and overall professionalism of your document are important. Treat this assignment as a formal document given by a real-world client. Treat the lecturer as your main client and the Coordinator (Shahab) as the CEO. Direct all queries to the lecturer or Coordinator.
* Please note that you may lose marks for any unprofessional work that can include spelling mistakes, grammatical errors, poor formatting and layout.
* You can collaborate (discuss) but the submissions MUST be individual work. No plagiarism of others’ work is allowed and will result in serious consequences.

# Introduction and case study

Read the following case study and give a solution to address the Business Intelligence issues faced by the organisation.

Alison Trump’s Business Intelligence System for

Financial Market Analysis and Prediction

Alison Trump’s Investment Management Company (AT) manages about $1.2 billion in assets, for both organisational and individual investors primarily in the share markets and in investment funds. Investors include a large superannuation fund and a large international bank, making AT one of the largest fund management firms in Australia and New Zealand. They use computerised information systems to assist them in day to day operational and tactical decisions that have to be made as well as to analyse existing information for strategic purposes. The data warehouse stores most data and information needed.

They began managing investment capital with AI-based technologies in the late 1990s due to the difficulties faced in using conventional approaches. Increasing difficulties in meeting deadlines and benchmarks as well as difficulties involved in retrieving relevant information from large data sets, and presenting the information in ways that would allow the executives to make appropriate decisions continue to cause problems. Although AT uses a variety of technologies to assist with various tasks ranging from macro-economic analysis to portfolio optimisation, the focus of this exercise is to build a computerised business intelligence infrastructure that would enable better prediction of the performance of financial products such as shares.

**THE PROBLEM:**

Simply stated, AT’s objective is to maximise the return on the assets it invests for its clients while minimising their risk exposure. AT believes that a key ingredient to successful investment is timing. For AT, it is not enough just to know which securities to purchase, but it is also important to know when to buy and sell securities. AT tries to determine whether the market is providing any signals about how it is likely to behave in the intermediate term (i.e. a few months), and bases investment decisions on these signals. AT believes that these objectives can be achieved by providing its financial professionals with an insight into financial markets. To enable this, AT plans to use a combination of high-quality analytical tools together with highly efficient computer engineering and market-savvy analysts similar to the INFOSYS 330 graduates! Staff of AT comprises a core group of financial analysts, computer scientists, and portfolio managers. The analytic staff spends a good deal of time studying balance sheets and market patterns to better understand factors that influence financial markets. The firm also utilises tools to help make better investment decisions.

AT continues to search for better tools for evaluating investment scenarios. AT is one of the few firms that use AI technology combined with statistical and financial analysis, as a primary means to manage its portfolios. However, it is extremely difficult to find consistent tools that model financial markets well. These markets are complex and only partially understood. Prediction, even in the short term, is a very difficult exercise. The problem of developing a system to estimate future prices is daunting because financial processes are generally characterised by high-levels of non-linear and complex situations, making them hard to model.

The amount of data available to an analyst is incredibly vast. Furthermore, financial markets are constantly evolving hence, models must adapt to these changes. AT’s system must reflect such adaptations to the following:

* On a day-to-day basis, random shocks, crowd psychology, and short-lived trends influence financial markets in complex ways. A financial domain is characterised by many micro-economic and macro-economic relationships among many complex and often poorly understood variables. The system needs to therefore incorporate domain knowledge that keeps changing on a daily basis.
* It is quite common to have widely varying interpretations of the data from different experts even after an event. Often, even experts cannot reason what principles they followed to make a particular trading decision!
* As a result of the complex interaction of market forces, financial markets behave in very complex and non-linear ways. The system must therefore analyse and deal with large amounts of complex economical and financial data generated on a daily basis from many original sources. A financial strategy that worked well in past markets may not work well in the present or in the future!
* The market is also influenced by natural or man-made disasters and important events – such as wars and rumours of wars, tornadoes, tsunamis, earth quakes, famine, pestilence, royal weddings, as well as financial situations like recessions experienced by most countries in the world!

Therefore there is a need for AT’s research group to search for solutions that highlight possible market opportunities so that analysts could focus more thoroughly on understanding these situations. In fact, AT wanted a solution that can sift through vast amounts of data and discover interesting relationships. In other words, AT wanted to increase the intelligence density of market data in order to assist them to make investment decisions.

Initially AT had many objectives for a BI solution. However over time these became more focused to have a system that gave recommendations on individual financial products such as shares. Alison Trump’s Business Intelligence System for Financial Market Analysis and Prediction need to reflect the following factors:

* **The tool needs to give insight into the direction and magnitude of price movements over time.**

Correctly choosing a time horizon for prediction is an important facet. On one hand, making predictions in a very short time period is hard due to the high levels of noise and unpredictable factors (i.e. random effects) present in financial markets. Selecting too large a horizon is equally meaningless due to the high number of uncontrollable large scale factors such as politics, economic policies, effects of natural disasters on markets, etc. For these reasons, AT decided that a meaningful horizon is a window of about 12 weeks.

* **AT decided to evaluate each share relative to a fixed market indicator, such as the NZX50 or ASX200 since the market index provides a general standard of market performance.**

That is to say AT is an active share portfolio manager that seeks to outperform the market (as opposed to a passive portfolio manager that indexes its portfolio with the market and seeks only to match the market’s performance).

* **AT also wanted to integrate the results of the analysis into its current analytical processes and produce results in reasonable time through the integrated system.**
* **AT would use simulated trading systems to test the models.**

Models will also be tested (or validated) by back testing over several historical years to determine how they would have performed. This validation process takes into account things like realistic transaction costs etc.

* **The accuracy and consistency of a system would be used as a measure of the quality of the system.**

If the models used in the system recommended buying stocks in volumes that were not obtainable or if it conducted so many trades that transaction fees wiped out profits, the model would not be considered successful.

* **To be useful to AT the system needs to be able to interpret and analyse large amounts of market data and “update its view of the world” frequently and easily.**

The system should continually be able to access and assess economic and market data from a variety of sources and, using this data from different sources, indicate those shares that were likely to be winners and those that were more likely to be losers over the next 12 weeks.

AT has vast amounts of data although it may not be very clean. Errors in the data can be due to many and varied reasons.

* **AT does not need the system to make specific point predictions for prices on a specific date but needed it only to provide the decision maker with estimates of a share’s upside and downside potential.**

Also since the decisions will be made by a Portfolio Manager who will interpret the results of a prediction, it would be good if the system models can offer insight/explanations of the analysis. It is also important that the system fits smoothly into AT’s workflow and current modelling tools. To do this, the system also needs to interface smoothly with the financial databases where the market data are stored.

* **The system does not need to function in real-time.**

Since AT is interested in a 12-week time horizon, the decision maker is not going to be under second-by-second real-time pressure to make investment decisions.

* **The Scalability of the system must be considered.**

On the other hand since there would be thousands of securities to be analysed, the system must be able to perform the analysis on each individual security in a reasonable amount of time. The system must also be able to expand to accommodate additional securities and input factors, which are expected to be added over time.

* **To be practical the model should also be flexible enough to accommodate new market trends, new types of data, and portfolio objectives.**

The types of processes that AT plans to model are highly complex with many subtle interactions. Accordingly, AT feels that given the inherent uncertainty in the domain, it would be difficult for an expert to specify all relevant knowledge accurately. In addition, AT would prefer to take up as little of the firm’s expert traders’ time as possible – in both designing and using the system. Expert time is valuable; each hour away from market analysis or trading can cost real dollars. Furthermore, and more importantly, AT had found that it could be somewhat difficult for their expert traders and analysts to articulate their expertise, especially since the rules are complex and continually evolving.

In summary, each of the models must be compared on at least the following dimensions:

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| **Dimension** | **Target Solution** |
| Accuracy | Moderate |
| Explainability | Moderate |
| Response Speed | Moderate |
| Scalability | Moderate |
| Flexibility | High |
| Embeddability | High |
| Tolerance for complexity | High |
| Tolerance for noise in data | High |
| Independence from experts | High |

**Problems to address:**

**Please Note: The following questions may seem vague at first.**

However they are not vague, but gives you a setting similar to that which you will face in a real-world scenario. It also gives you the freedom to be creative and outgoing in your BI solution design.

1. Identify a business problem faced by Alison Trump that needs a BI solution. Give a detailed requirements specification, for which a BI solution is sort, identifying the stakeholders involved and the specific decisions they have to make. Make sure you clarify how the BI solution will benefit each stakeholder.

**(40%)**

1. Discuss **the most** **feasible BI application** **(or combination of applications)** selected for the BI solution suggested by you by carrying out the following. You may do each of the following sequentially or otherwise.
   1. Firstly, decompose the larger problem in to smallest possible part so that it becomes more linear and easier to solve… Think about the granularity of the problem. That is are you addressing the behaviours of shares in an industry, in a specific organisation or shares of an individual’s portfolio?
   2. Explain with reasons why one (or more) BI applications would best fit (over other possible solutions) the needs of AT for each decomposed part of the problem and how they syphon data/ intelligence throughout the suggested system.
   3. Give a conceptual framework (diagram) to describe the combined system. Explain what inputs and outputs each decomposed part must have.
   4. Give detailed instructions to the system development team, to enable them to get started on the implementation of the system.
   5. Critique the solution you have finally selected.

Hint: Scope the problem in a manageable manner. Please do not try to solve all the problems of the organisation.

**(60%)**