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Instructional Note

An Activity-Based Costing Assessment Task: Using an Excel Spreadsheet

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Abstract

The aim of using an Excel Spreadsheet as a teaching instrument for an Activity-Based Costing assessment task is to motivate students and to provide them with the opportunity to learn computing skills as well as cost accounting techniques. The assessment task is designed to encapsulate the skills required to create a complex spreadsheet using various commands. Students work individually on the assessment task using a framework provided to assist them to construct the various layers within the activity-based cost model. The use of computer technology assists students to gain a personal understanding of the issues, and to develop a specific set of skills that are useful for management accountants. This task encourages students to learn and develop critical analytical skills. Furthermore, this paper describes and explains an approach to integrating VB macros into key stages of learning progression.

Key words: *Activity-Based costing, Excel spreadsheet, Computing skills.*

Introduction

Activity-Based Costing (ABC) is a relatively well known alternative method, to the traditional standard cost approach, for calculating the cost of products or services (Miller 1996; Gunasekaran et al 1999). Johnson (1988) stated that the major assumption underpinning ABC is that resource consuming activities cause costs. As a result organisations need to be aware of the possibility that they could be “miss-costing” their products or services (Turney 1989). Miss-costing is effectively a “cross subsidy” which occurs because volume related cost drivers fail to correctly identify and trace volume unrelated activities.

One of the benefits of the spreadsheet is that all the elements should be ‘visible’ right from the outset. Data and structural relationships between data elements are represented on the screen and, as their values change, they (and that includes any dependent data) change immediately. The examples provided during the course computer lab sessions support a gradual transition from merely using a spreadsheet for the purpose of calculating a large volume of figures to a more sophisticated spreadsheet involving greater use of various tools available in Excel. This includes the use of macros with the first Visual Basic (VBA) macro introduced at a fairly early stage of the course. Every command is explained to the students and demonstrated, thus by replicating the manual operations student’s can observe the links being made. This is the first step towards automation and the use of macros. Student-designed macros generally require only one line of code.

This approach to teaching Excel tools is intended to balance technique with method. Design of the ABC spreadsheet model is a creative and iterative process involving matching the problem formulation to known computational techniques (Sommerville 1992). The teaching in the computer lab sessions contributes to the learning by directing and demonstrating a path through the vast array of objects, properties and methods used by VBA for the development of the specific application. A good foundation in the techniques is critical since any “apparently trivial difference in functionality” can be “crucial to producing a satisfactory system.” (Edwards & Kidd 1994). Understanding macros is essential if student’s are to take full advantage of the power that the spreadsheet has for problem solving, and VBA for Excel is certainly a valuable tool for advanced applications. Conceptually, incorporating macros in spreadsheets provides a good learning experience for students.

Having achieved an advanced level of designing Excel spreadsheets and using macros, the student will have the capability to apply their learning to make and implement some explicit and interesting design decisions.

Overview of Learning Objectives

Case Learning Objectives

The learning objectives of this task are aimed at addressing a number of key graduate attributes generally aligned to the learning outcomes of management accounting courses. These graduate attributes are identified as:

- *Analytical skills*; each student is required to analyse the data provided in the case scenario and design a MSEXcel spreadsheet that meets the needs of the Activity Based Costing model (instructions provided in the overview of the case).
- *Application of Accounting Knowledge*; each student is required to demonstrate their knowledge of the various management accounting issues inherent in the case study, which in this circumstance is related to the application of Activity Based Costing.
- *Computing skills*; each student is required to demonstrate their competent use of technology, which in this circumstance is related to MSEXcel (the spreadsheet must communicate results and provide the information for management).

- *Communication skills*; each student has to demonstrate their ability to write competently and professionally, which in this circumstance is related to both the instruction documentation and the analysis required in a report.

Assessment is based upon the above learning objectives and follows a traditional pedagogical approach with the students having been given very specific instructions and the lecturer/tutor merely providing guidance and feedback as the assessment task progresses. This assessment was used for accounting students in their final year, however, the activity could be applied to second year students depending upon the degree structure.

Implementation Guidelines

Excel Spreadsheet Accounting Program Instructions (provided to students)

The assessment task requires the development of an Excel spreadsheet using advanced programming techniques. The spreadsheet should consist of a front-end screen with calculations and VBA commands on hidden worksheets. The case study (practice set) requires the application of cost accounting techniques with regard to activity-based costing in a service industry environment. In addition to the practical calculation of accounting information there are discussion questions concerning the relevance and underlying issues of activity based costing. Details are contained in the practice set "**Last Australia Bank**". The task is designed to reinforce your learning and understanding of accounting through application to a realistic scenario. The assessment will focus on the level of sophistication involved in the spreadsheet as well as the capacity to evaluate alternative data to the basic problems. A written overview of the application should be submitted in business report format. The application software should be submitted on a CD; students are required to demonstrate that the software operates correctly in their computer lab session.

The ABC Assessment Task Overview

Students were provided with a set of general instructions, a detailed list of costs and a marking criteria guideline which provide a useful framework for their preparation and computing activities. The task is based upon a problem derived from the text book by Hansen and Mowen (1999) and modified to accommodate the requirements for a spreadsheet application of the activity based costing method.

The Excel Spreadsheet Instructions

The Excel spreadsheet framework is based upon the process of logically following the key aspects of the ABC task. The recommended process follows the approach suggested by Mather (1999) and the following instructions were therefore provided to the students:

Step 1. Identify the required inputs and outputs.

Students were required to determine the desired outputs from the spreadsheet in order to achieve the objective of the task. The inputs are in principle the information required to produce the outputs.

Step 2. Establish the logic flow.

This required the students to identify the links between inputs and outputs thereby establishing the variables. The flow of information between the variables should be documented using a graphical representation, such as a diagram.

Step 3. Categorise the variables.

- *Variable inputs:*
 - Amounts that are likely to change in the performance of the task.
- *Constant inputs:*
 - Amounts that can be considered as constant over the scope of the task.
- *Intermediate variables:*
 - Variables that are introduced to link inputs and outputs.

- *Key outputs:*
 - The outputs that are the objective of the task.

Step 3. General rules.

- There should be only one entry point for the values of all variables. Use cell references for any other cell that requires the value. A single location overcomes the possibility of errors through inconsistency.
- Do not use constant values in a formula. Formulae should consist of functions and cell references linking to the constant value cell.

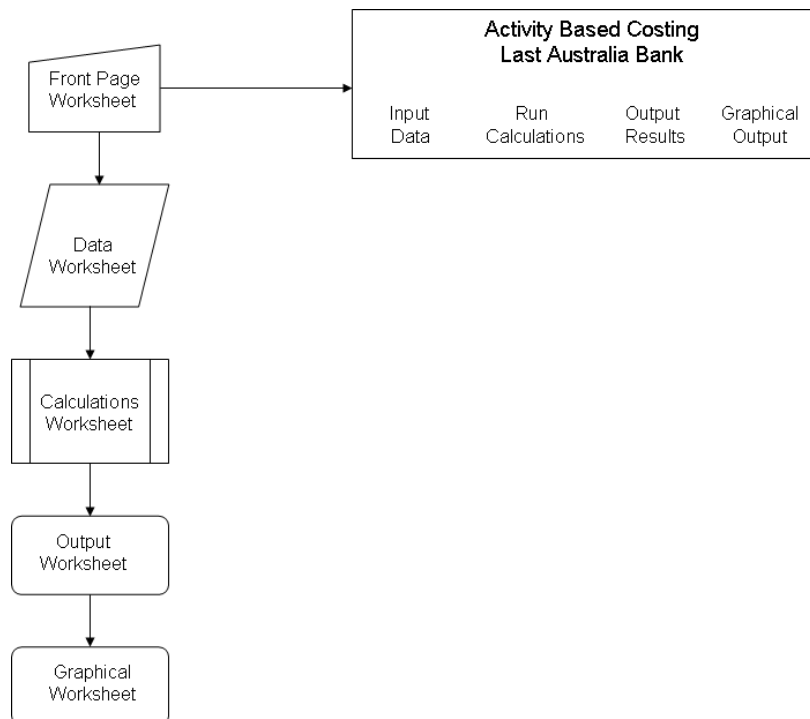
Step 4. Create separate worksheets.

Use multiple worksheets to deal with different aspects of the ABC model.

- *Front Page:*
 - The front page (worksheet) should serve as the starting point and interface for the ABC model.
- *Constants Page:*
 - This page (worksheet) serves as the only point of entry for the constant inputs.
- *Calculations Page:*
 - This page (worksheet) contains all the relevant formulae.
- *Output Page:*
 - This page displays the results of the ABC model.

Diagram 1.

General Overview of Spreadsheet



Assessment Criteria Guide

Even though prior research (Teo & Tan 1999; Allwood 1984; Galletta et al 1996; Panko 2000) has indicated that error detection is generally a difficult process, there are guidelines to help with error detection (Whittaker 1999) and these are presented here to assist in understanding the evaluation of the spreadsheet assignment.

In the development stage students should:

1. Understand the spreadsheet objectives;
2. Plan the overall spreadsheet design;
3. Identify all inputs required;
4. Determine all calculations required; and
5. Determine the format of the output required.

In the review stage students should have allowed for:

1. Separate input, calculation, and output worksheets;
2. Links between worksheets;
3. Hidden worksheets, rows and/or columns;
4. The existence of hard-coded values in calculations and/or output worksheets; and
5. Adequate documentation explaining the system and its use.

In the evaluation stage students should have determined that:

1. All important information has been included that satisfies the problem requirement;
2. All input has been entered accurately; and
3. Any changes to input are appropriately reflected in changes to output.

The criteria for assessing and allocating marks are presented in Appendix B. This approach is designed to be congruent with both the instructions provided to the students as well as the guidelines for error detection (Whittaker 1999).

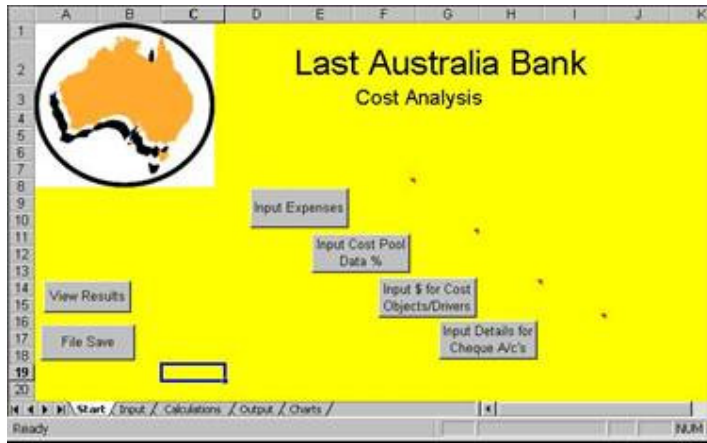
Examples of Visual Basic Macros from a Student Spreadsheet

To provide some insight into the expected level of work required from students the following extracts are provided with comments. The comments are intended to clarify some issues that might otherwise cause concern in the approach to assessing and marking the work of the students.

The first example is a basic front page, which is presented in Diagram 2 below. This is a reasonable attempt on the part of the student and demonstrates that the individual has given some thought to the planning and design of the spreadsheet. The use of Buttons to move to specific areas in other worksheets is a good use of macros. The inclusion of Comments to explain the buttons is satisfactory. However, the better spreadsheets incorporated: an instructions guide page with links; there were more advanced techniques employed in the design of the page (whilst the front screen or main page is colourful it is just satisfactory); more macros and links were made including an instructions page.

Diagram 2.

Example of a Main Page for Spreadsheet



The next example, which is presented in Diagram 3 below, is from the calculations worksheet and is the formula for deriving the standard cost. This is a reasonable attempt on the part of the student and demonstrates that the mathematical calculations are linked to the Input worksheet where the data is entered and stored. The calculation will produce a different answer should the data be changed. A simple use of formula however, this does show that the student has applied the basic cost calculation. However, the cell references could be improved by locking them to the specific cell for example, $\$B\$6/\$B\5 . This is satisfactory since it produces the correct answer and demonstrates some understanding of the spreadsheet however, there could have been more analysis to avoid potential problems should the cell references change.

Diagram 3.

Example of Standard Cost Calculation

Standard Cost Rate	
Overhead costs	=Input!C45-Input!C28-Input!C30
Direct costs	=Input!C28*Input!C30
Overhead rate	=B6/B5

The next example, which is presented in Diagram 4 below, also appears in the calculations worksheet and is the formula to derive the profit or loss per cheque account according to the average balance. This is also a reasonable attempt on the part of the student and demonstrates that the mathematical calculations are linked to other parts of the calculations worksheet where the Activity-Based Costs are calculated. This is a simple set of formula and shows that the student has applied the basic principles to determine profit or loss for each of the relevant categories of cheque accounts. However, as previously mentioned the cell references could be improved by locking them to the specific cell, it is interesting to note that in some cell references the student has done this, refer to the cells for the formulas of Expenses. The student has also used an IF statement to identify the result as either "Profitable" or "Loss" and this indicates some thought on the part of the student. Unfortunately, there are problems in the formula, in particular the categories are hard coded and more of a concern the revenues have hard coded figures. This is considered satisfactory since it produces the correct

answer and demonstrates some understanding of the spreadsheet however, there could have been more analysis and improvements to avoid potential problems.

Diagram 4.

Example of Cheque Account Profitability

<i>Average Balance</i>	<i>400</i>	<i>750</i>	<i>2000</i>	<i>5000</i>
Revenues	=D23*0.04+60	=E23*0.04+60	=F23*0.04	=G23*0.04
Expenses	=Calculations!\$D\$51	=-(Calculations!\$D\$51*(E23*0.02))	=-(Calculations!\$D\$51*(F23*0.02))	=-(Calculations!\$D\$51*(G23*0.02))
Profit per account	=SUM(D24:D25)	=SUM(E24:E25)	=SUM(F24:F25)	=SUM(G24:G25)
	=IF(D26>0,"Profitable","Loss")	=IF(E26>0,"Profitable","Loss")	=IF(F26>0,"Profitable","Loss")	=IF(G26>0,"Profitable","Loss")

Summary

The example presented above highlights the issues that may generally occur in a basic spreadsheet. This provides some guidance for the assessment process which follows the instructions and marking criteria. The use of Excel spreadsheets as an assignment can be useful in providing new insights and can be a valuable learning experience for students regardless of the level of prior experience that they may have with Excel. In effect, the assignment is an attempt to encourage each individual student to apply knowledge gained from prior learning as well as reinforce the learning from the current course. Whilst this example was based on formulating and answering the requirements of an Activity-Based Costing scenario the principles are transferable and just as applicable to other assessment tasks involving the design of a suitable spreadsheet.

In summary, the assignment proved to be a useful method for engaging the students in the learning process. There were a number of issues that had to be dealt with during the semester the most significant of which was the difference in experience with the use of Excel spreadsheets between students. To overcome this problem, students with the experience were encouraged to assist in the computer lab sessions as mentors supervising and providing guidance.

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Appendix A Activity-Based Costing ~ Consulting Assignment

The **Last Australia Bank** has operated for many years under the assumption that profitability could be increased by increasing dollar volumes. Historically, LAB's efforts had been directed towards increasing total dollar sales and total dollars of account balances. In recent years, however, LAB's profits were eroding. Increased competition, particularly from Mortgage Lenders, Credit Unions and Building Societies, was the cause of the difficulties. Also LAB's managers had no idea what their products were costing. Upon reflection, they realised that they had often made decisions to offer a new product, which promised to increase dollar balances, without any consideration of the actual cost to provide the service. In an attempt to clarify costs, the bank's managers calculated the cost of the products using a traditional costing approach. The results are:

Standard Cost							
Overhead costs	\$3,795,000.00						
Direct costs	\$1,280,000.00						
Overhead rate	\$0.34						
		<i>Cheque A/C</i>	<i>Personal Loans</i>	<i>Savings A/C</i>	<i>M/C</i>	<i>Gold M/C</i>	
	Overhead Costs	\$1,382,334.79	\$1,423,125.00	\$506,100.72	\$453,224.52	\$30,214.97	\$3,795,000.00
	Direct Costs	\$466,242.04	\$480,000.00	\$170,700.64	\$152,866.24	\$10,191.08	\$1,280,000.00
	Total	\$1,848,576.83	\$1,903,125.00	\$676,801.35	\$606,090.76	\$40,406.05	\$5,075,000.00
	Per account	\$41.08	\$95.16	\$17.81	\$17.32	\$3.37	

Managers at the bank are not certain that the costing is a true reflection of the products' contribution to profit. They have been advised that there is an alternative method to costing known as Activity-Based Costing. After some discussion, the bank decided to hire a consultant management accountant to compute the costs of the products: cheque accounts, personal loans, the standard M/C card, and the gold MC card. You (the consultant management accountant and an expert in Activity Based Costing) have identified the following activities, costs, and activity drivers based on discussion and interviews with staff and a review of the bank's annual data:

Expenses	Amount	Direct to cost object					Sub-total	Indirect ~ Cost Pools					TOTAL	
		<i>Cheque A/C</i>	<i>Personal Loans</i>	<i>Savings A/C</i>	<i>M/C</i>	<i>Gold M/C</i>		<i>ATM Service</i>	<i>Computer</i>	<i>Customer</i>	<i>Admin</i>	<i>Counter</i>		
		%	%	%	%	%	%	%	%	%	%	%	%	
Customer Service Staff	\$800,000.00	45%	5%	25%	15%	10%	100%							100%
Computer Staff	\$500,000.00	20%	1%	2%	1%	1%	25%	10%	60%				5%	100%
Lending Staff	\$480,000.00	20%	65%	5%	5%	5%	100%							100%
Admin staff	\$950,000.00											100%		100%
Cleaning	\$300,000.00							10%	15%	15%		35%	25%	100%
Auditing	\$260,000.00											100%		100%
Statement Stationery	\$38,000.00								100%					100%
ATM Stationery	\$12,000.00							100%						100%
Stationery general	\$10,000.00								10%	30%		60%		100%
Electricity	\$240,000.00							5%	15%	10%		30%	40%	100%
ATM Phonelines	\$50,000.00							100%						100%
Telephones	\$34,000.00								5%	60%		10%	25%	100%
Insurance	\$720,000.00							10%	10%	25%		30%	25%	100%
Postage	\$36,000.00									25%	40%	30%	5%	100%
Depreciation	\$280,000.00							5%	20%	15%		25%	35%	100%
Rent/Leases	\$365,000.00							5%	5%	30%		25%	35%	100%
	\$5,075,000.00													

The following annual information regarding the three products was also accessed:

List of Cost Drivers						
Description	Total	<i>Cheque A/C</i>	<i>Personal Loans</i>	<i>Savings A/C</i>	<i>M/C</i>	<i>Gold M/C</i>
Customers (accounts)	150,000	45,000	20,000	38,000	35,000	12,000
Counter transactions	90,580	66,000	500	24,000	30	50
Customer inquiries	688,000	366,000	60,000	134,000	120,000	8,000
Computer Transactions	2,581,000	2,000,000	200,000	1,000	300,000	80,000
ATM Transactions	330,000	180,000	8,000	82,000	38,000	22,000

In view of the new cost information, Brenda Miller, the General Manager, wants to know whether a decision made two years ago to modify the bank's cheque account product was sound or not. At that time the service charge was eliminated for accounts that had an average balance greater than \$1,000. Based on increases in the total dollars in cheque accounts, Brenda felt very pleased about the new product at the time.

This cheque account product is described as follows:

- Cheque account balances greater than \$500 earn interest of 2% per year, and
- A service charge of \$5 per month is charged for balances less than \$1,000.

The bank earns 4% on cheque account deposits. Fifty percent of the accounts are less than \$500 and have an average balance of \$400 per account. Ten percent of the accounts are between \$500 and \$1,000 and average \$750 per account. Twenty-five percent of the accounts are between \$1,000 and \$2,767. The average balance is \$2,000. The remaining accounts carry a balance greater than \$2,767. The average balance for these accounts is \$5,000. Research indicates that the \$2,000 category was by far the greatest contributor to the increase in dollar volume when the cheque account product was modified two years ago.

Your consulting appointment requires you to create a computer spreadsheet and provide a report that addresses the following:

1. Calculate the rates for each activity.
2. Using the rates computed, calculate the cost of each product.
3. Evaluate the cost and profitability of the cheque account product.
 - Are all accounts profitable? Identify any products that could be dropped/cancelled.
 - Compute the average annual profitability per account for the four categories of accounts described.
 - Make recommendations to increase the profitability of the cheque account product.
4. Discuss the advantages of adopting an Activity Based Costing system for the activities of the bank.
5. Demonstrate the computation on a spreadsheet that you have created for this particular client.

Your management report should follow the basic structure of a business report. That is, you should provide the following:

- *A cover page (the Topic, the Company, your name);*
- *An executive summary (a short summary of the main issues/findings/recommendations) ;*
- *An introduction (why you are doing the analysis – the problem in brief);*
- *The body of the report – items 1 to 4 above;*
- *References (to justify methods or interpretations);*
- *Appendices (if required).*

Appendix B Assessment Marking Criteria

Spreadsheet Assessment Guide

Criteria	Excellent	Very Good	Good	Satisfactory	Less than Satisfactory
Objective	Completely covers the problem requirements. Greater depth of insight.	More than adequately meets the problem requirement. Some depth of thought.	Does adequately meet the problem requirement.	Does meet the problem requirement.	Does not meet the problem requirement.
Design	Complete & accurate documentation. Separate worksheets. Calculations & output linked by complex formulas. Includes new parameters ability. Intricate hidden worksheets, rows, columns. No hard coded values.	More than adequate documentation. Separate worksheets. Calculations & output linked by logical formulas. Facility for new parameters. Hidden worksheets, rows, columns.	Adequate documentation. Separate worksheets. Calculations & output linked by values &/or formulas. Consideration for new parameters. Some hidden worksheets, rows, columns.	Satisfactory documentation. Separate worksheets. Calculations & output linked by values. Attempt to accommodate new parameters. Very basic hidden worksheets, rows, columns.	Less than satisfactory Documentation; Worksheets; Calculations; Output links.
Input	All important input included. Additional input allowed and checked for verification. Input is accurate.	All important input included. Additional input allowed some verification. Input is accurate.	All important input included. Some additional input allowed. Input is accurate.	All important input included. Input is accurate.	
Calculations	Calculations and formulas are: Accurate and Logical.. Use of sophisticated range of formulas. Extensive use of named cells and ranges. No errors use of control checking.	Calculations and formulas are: Accurate and Logical.. Use of a wider range of formulas. Named cells and ranges. No errors	Calculations and formulas are: Accurate and Logical.. Use of a range of formulas. No apparent errors	Calculations and formulas are: Accurate and Logical. No apparent errors.	Calculations and formulas have errors.
Output	Output is more innovatively presented. Shows depth of understanding. Format is very easy to follow and useful for much wider decision making.	Output is more logical and easier to follow. Format is useful for various decisions and easy to follow for.	Output is more than basic requirements. Format is easy to follow for decision making.	Output is satisfactory only. Format very basic for decision making.	Output does not meet requirements.

<i>Check List</i>	<i>Yes/No</i>	<i>Level of use/application</i>
Sum command		
IF statement		
Lookup Tables		
Buttons		
Macros		
Visual Basic		
Hidden worksheets		
Instructions / explanations		
Links between worksheets		
Links within worksheets		