Tutorial Letter 301/0/2023

Software Project Management
INF3708

Year Module(s)

DEPARTMENT OF INFORMATION SYSTEMS

IMPORTANT INFORMATION

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1. Introduction

Greetings fellow students! This is Tutorial 301. In this tutorial, I respond to errors concerning questions about the payback period in Assessment 2. Numerous INF3708 enrolees have reported that something is not quite right with the payback period. In response and under the (mistaken) perception that these students are not applying the payback period formula correctly, I would instruct them to find at least two different formulas to calculate the payback period to determine if these formulas produce the same result. If my response seems dismissive, I apologise, as it was not my intention to appear dismissive. Examiners are confident that their quiz questions and associated answers are correct because assessments are moderated. However, both the moderator and the examiner can be wrong.

In what follows, I explain the steps that led to the erroneous payback period and the corrective actions I applied. In addition, I shed light on other questions that seem vague. Finally, you cannot be penalised for an examiner's error; in the final section, I explain the corrective measures I applied. This tutorial letter draws on Schwalbe (2019) and the Indeed Editorial Team (2023).

2. Payback period

Payback period is the length of time it takes to recover investment cost. I pose the following question to you:

Study the cash flow of Project Y in the table below (see Table 1). Calculate the payback period.

Table 1. Project Y

Year	Project Y
0	-R200 000,00
1	R70 000,00
2	R75 000,00
3	R80 000,00
4	R85 000,00

I used (and perhaps over-relied on) Microsoft Excel to ensure the accuracy of my calculation. Below, I reveal how the error emerged.

2.1. Step 1: Calculate the annual cumulative cash flow

To calculate the annual cumulative cash flow of YEAR 1, you add the cash flow amount of YEAR 1 to the initial investment of R200 000 (YEAR 0), which produces an answer of -R115 000. Subsequent annual cash flows (YEARS 2–4) are calculated by adding the cumulative cash flow of the previous years to the cash flow of the current year. Figure 1 illustrates how the Excel formula has been applied.

	A	B	C
1	Year	Project Y	cumulative cash flow
2	0	-200000	
3	1	85000	=B2+B3
4	2	70000	=C3+B4
5	3	78000	=C4+B5
6	4	33000	=C5+B6
7			

Figure 1. Excel formulas to calculate annual cumulative cash flow

The Excel formulas applied in Figure 1 produce the cumulative cash flow as illustrated in Figure 2.

	A	B	C
1	Year	Project Y	cumulative cash flow
2	0	-R200 000,00	
3	1	R85 000,00	-R115 000,00
4	2	R70 000,00	-R45 000,00
5	3	R78 000,00	R33 000,00
6	4	R33 000,00	R66 000,00
7			

Figure 2. The annual cumulative cash flow is displayed in column C.

2.2. Step 2: Calculating the payback period

The formula to calculate the payback period is as follows:

Payback period = A + (B / C).

- A: the last year with a negative cash flow.

- B: cumulative cash flow at the end of that year.

- C: cash flow during the following year.

This formula, directly transferred to MS Excel, looks as follows (see cell B8 in Figure 3):

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	A	B	C
1	Year	Project Y	cumulative cash flow
2	0	-200000	
3	1	85000	=B2+B3
4	2	70000	=C3+B4
5	3	78000	=C4+B5
6	4	33000	=C5+B6
7			
8	Payback period:	=A4+(C4/B5)	

Figure 3. Payback period formula applied in MS Excel

The Excel formula applied in Figure 3 produces the result shown in cell B8 of Figure 4:

	A	B	C
1	Year	Project Y	cumulative cash flow
2	0	-R200 000,00	
3	1	R85 000,00	-R115 000,00
4	2	R70 000,00	**-R45 000,00**
5	3	R78 000,00	R33 000,00
6	4	R33 000,00	R66 000,00
7			
8	Payback period:	1,4	

Figure 4. The Excel formula produces a payback period of 1.4 years.

The purported payback period of 1.4 years is incorrect. This incorrect value was produced because Excel, when applying the provided payback period formula directly, computes the subtraction symbol that precedes the cumulative cash flow of YEAR 2 (i.e. -R45 000). Indeed, the subtraction symbol should not be calculated, but must simply serve as visual illustration that YEAR 2 is the last year with a negative cash flow. In this regard, it is also worth noting that the negative values still represent inflow of cash. Therefore, the calculation must be as follows:

Payback period = the last year with negative cash flow + (cumulative cash flow at the end of that year / cash flow during the following year)

Payback period = 2 + (**R45 000,00**/R78 000,00) = 2,6 years

Since Excel does not omit the subtraction value, the payback formula applied in Excel must be adjusted as follows (see cell B8 in Figure 5):

	A	B	C
1	Year	Project Y	cumulative cash flow
2	0	-200000	
3	1	85000	-115000
4	2	70000	**-45000**
5	3	78000	33000
6	4	33000	66000
7			
8	Payback period:	=A4-(C4/B5)	

Figure 5. The payback period formula adjusted for MS Excel

Note that the addition symbol that follows the YEAR has been replaced by a subtraction symbol to cancel out the subtraction symbol that preceded the cumulative cash flow of that year. The Excel formula applied in Figure 5 produces the correct payback period that is shown in cell B8 of Figure 6:

	A	B	C
1	Year	Project Y	Cumulative cash flow
2		0	-R200 000,00	
3		1	R85 000,00	-R115 000,00
4		2	R70 000,00	**-R45 000,00**
5		3	R78 000,00	R33 000,00
6		4	R33 000,00	R66 000,00
7			
8	Payback period:	2,6	

Figure 6. 2,6 years is the correct payback period

3. Other questions that might be unclear

3.1. Return on investment

I asked three questions that focus on return on investment (ROI). Two of the questions focus on calculating the ROI that involves total investment cost and annual profit; you can apply the generic ROI formula with concern to these two questions. One question focusses on calculating ROI first requires you to calculate total discounted revenue and total discounted expenses. You

can use the ROI formula for multiyear projects in this instance. In structuring the questions, some information is left out intentionally because it is expected of third-year-level students to fill in the blanks (make strong assumptions).

3.2. Activity-on-node diagram

Confusion regarding questions that focus on the activity-on-node diagram stems from the table that indicates that Activity L is preceded by Activities I and J, but Activity L on the diagram is preceded by Activities H and I. The discrepant predecessors can be an error but can also be representative of alternative timelines. Calculate the early start (ES), early finish (ES), late start (LS), and late finish (LF) of both timelines to determine which ES, EF, LS, and LF matches one of the four options presented in the quiz.

4. Sources consulted

- Indeed Editorial Team. (2023). How to calculate a payback period (formulas and examples). Retrieved from Indeed website: https://www.indeed.com/career-advice/career-development/how-to-calculate-payback-period-formula

- Schwalbe, K. (2019). *Information technology project management* (9th ed.). Boston, USA: Cengage Learning.

5. In closing

I dedicate this tutorial letter to the students who contacted me about the erroneous payback period question. I applaud your search for the correct and relevant knowledge. Students will not be penalised for the two questions that focus on the payback period. I configured the two quiz questions about payback period, to accept any of the four options presented as *correct.* This method prevents 2 marks from being deducted from the total quiz score; however, if you skip the question for any reason, you will not receive a mark.

Thank you and best wishes,

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Enter Jiraiya's honoured sage style: Bath of boiling oil!