

Project L12

Instructions to the candidate

- (i) Read the attached document, which describes the background to this project. You will also be given an additional piece of information later on in the day.
- (ii) Scenario 1: build a model that projects the daily numbers of bananas of each grade during all transportation stages, using the transition rate matrix provided.
- (iii) Use a chart to illustrate the deterioration of bananas over the second transportation period, i.e. during shipping from the Depot to Cohortico.
- (iv) Perform the necessary expense and income calculations, and then perform a discounted cashflow calculation that enables you to determine prices payable to the producers for the bananas in order to meet the given profit criterion. Calculate also the internal rate of return (IRR) from this overall transaction.
- (v) Repeat steps (ii) to (iv) as necessary for Scenario 2, using the prices determined under Scenario 1 to determine the revised level of profit and IRR.
- (vi) Repeat steps (ii) and (iv) as necessary using the additional information (Scenario 3) given to you later in the day.
- (vii) Prepare a summary of five or six pages, capturing the main features and results. You can assume that the summary is being prepared for your boss, a qualified actuary, who will tomorrow present the work to BDS.

You should cover the following:

- data, approach and assumptions used
- results, i.e. graphs, prices per banana (paid to the producers), profit levels and IRRs
- results using the new information
- conclusions, including suggested next steps

END

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Background

The company Banana Distribution Services (BDS) is a banana wholesaler operating in the country of Actuaria. It purchases the bananas from growers in Actuaria and then ships them overseas to banana retailers in Cohortico.

Bananas are graded by quality: A = Premium, B = Good, C = Acceptable. Grade F is used to denote bananas that are effectively rotten and must therefore be discarded.

BDS purchases its bananas from two producers, Producer X and Producer Y. These producers each run a large banana plantation, and these plantations are located in two different parts of the country. This season BDS has arranged to collect the following numbers of bananas from these producers:

<i>Grade</i>	<i>Producer X</i>	<i>Producer Y</i>
A	100,000	175,000
B	200,000	300,000
C	100,000	100,000

BDS is responsible for transporting the bananas in boxes from the plantations to its coastal Depot by road. The journey from the plantation of Producer X to the Depot takes 25 days, and for Producer Y it takes 15 days. BDS arranges its transportation so that the bananas arrive at the Depot at the same time. They are then sorted and repackaged together in new boxes for onward shipment. The sorting process at the Depot costs BDS \$4,000 (where \$ denotes Actuarian dollars). The journey by ship to Cohortico is also arranged by BDS and takes 20 days.

The numbers of bananas per box for each stage of the transportation are as follows:

	<i>Number of bananas per box</i>
Road	3,000
Ship	75,000

The transportation costs for each stage (in Actuarian dollars \$) are as follows:

	<i>Fixed cost per day \$</i>	<i>Additional cost per box per day \$</i>
Road	500	10
Ship	2,500	25

Once the bananas are received in Cohortico they are again sorted into grades (at no cost to BDS) and BDS receives the following payments per banana from the retailer (in Actuarian dollars \$):

<i>Grade</i>	<i>Payment per banana \$</i>
A	0.5
B	0.3
C	0.1

The main problem facing BDS is that the quality of bananas deteriorates on a daily basis during transportation. The daily transition rates between grades have been estimated as follows:

<i>From:</i>	<i>To:</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>F (Rotten)</i>
<i>A</i>	-	0.20%	0.10%	0.05%	
<i>B</i>	-	-	0.75%	0.50%	
<i>C</i>	-	-	-	2.00%	

Scenario 1

BDS has asked you to perform a projection of the daily deterioration of banana quality during the two stages of their transportation, and hence to calculate the total expenses incurred by BDS throughout the transportation process and the total income expected to be received from the Cohortican retailers.

You have also been asked to calculate the prices per banana that could be paid to the producers in order for BDS to earn a net present value profit of \$10,000 (based on the information provided above). BDS wishes to pay the same prices per banana to each of Producer X and Producer Y, but does not feel that it is appropriate to pay the same price for each grade of banana. You have therefore also been asked to make an assumption about how the prices payable to the producers should vary by grade.

The risk discount rate to be applied is 15% per annum. Inflation in Actuarial has been extremely low for the past few years.

BDS would also like to know the internal rate of return that it will earn from the overall transaction.

Scenario 2

BDS has also heard a rumour that banana blight has struck the Actuarian banana plantations. This is expected to cause much damage, with an expected loss of 25% of the total banana crop. This would mean that the two producers would have to reduce the amounts sold to BDS correspondingly. Furthermore, the banana blight weakens the surviving fruit and the transition rates to lower grades are expected to double as a result.

BDS has therefore asked you to repeat your banana projections assuming that this rumour is correct, and to calculate the impact on net present value profit and internal rate of return if the prices paid to the producers per banana remain the same as were determined under Scenario 1.

A further piece of information will be provided later on in the day.

END

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Additional information

To be provided later on in the day

Scenario 3

BDS is now wondering whether it is such a good idea to collect and then ship Grade C bananas, given that a reasonable proportion of them are expected to go rotten during the separate stages of transportation.

They have therefore asked you to repeat your projections under Scenario 1 (i.e. ignoring the banana blight rumour) assuming that:

- Only the promised Grade A and Grade B bananas are purchased and collected from the two producers.
- Only Grade A and Grade B bananas are shipped to Cohortico.
- The price paid to the producers per banana is the same as determined under Scenario 1.

BDS has specifically asked whether this action will result in increased profit and internal rate of return.

You are not required to produce any graphs for this scenario.

END