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SIMIODE *A SYSTEMIC INITIATIVE FOR MODELING INVESTIGATIONS & OPPORTUNITIES WITH DIFFERENTIAL EQUATIONS*

STUDENT VERSION
FINANCE - SAVINGS AND LOANS

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Abstract: We describe two situations, one in which we are saving for a purpose and one in which we are borrowing for a purpose. In the first case we ask for discrete and continuous model of the situation and in the second case we ask that the results of the model be used to examine some "what if" situations.

SCENARIO DESCRIPTION

We offer two situations. The first needs a savings model and the second needs a loan model.

Savings

Build two mathematical models to answer the given question for the following bank investment problem in two different ways (a) discrete difference equation and (b) continuous differential equation.

Invest $10,000 initially and add $2,400 each year in an interest bearing account that pays annual interest according to the following schemes: (a) [for the discrete difference equation approach] compounded annually at 3.2% or (b) [for the continuous differential equation approach] compounded continuously at 3.15% interest. State all your assumptions used in the model building process. Build your model very carefully and be sure to define your variables and units.

Compare your results over a reasonable period of time and critique the faithfulness to reality of each of your approaches.

Loan

Use a continuous differential equation approach to determine how long it will take to pay off a business debt of $150,000 which was given at an annual interest rate of 6.7% if we pay $1,900 per month. State all your assumptions used in the model building process. Build your model very carefully and be sure to define your variables and units. Show your analysis in detail.

In a reverse scenario, suppose you wanted to pay off the loan in 15 years. How much would your monthly payment be to do this?

Finally, do some sensitivity analysis in which you consider different interest rates (lower and higher) as well as different loan periods, i.e. time until the loan is paid off.