

Minimax Films  
8421 Diminish Blvd  
Hollywood, CA 90028

Mathemagicians, Ltd (MML)  
Suite 102, Love Building  
Tallahassee, FL 32306

Minimax Films produces and releases major motion pictures. Models of cash flow and gross tickets sells is a fundamental part of doing business. Currently Minimax is using the POP model (see appendix) from the firm of Proprietary, Over and Price for these tasks. Minimax wants to move to the new MML model (see appendix). This is a group project for groups of 1–4 students.

Your job is to explain to the accountants (who know business calculus) and the executives (who know nothing, but like to look at graphs showing data about movies that made a lot of money) how the MML model yields the same results as the POP model. The executives will not accept a report that isn't professional looking. It must be typed. The chairman has a sense of whimsy, but doesn't tolerate lateness. A rough draft or outline of the project is due Friday 5 Novemeber at Noon and the final copy is due on Monday 15 November at Noon.

Two additions to the MML model should be also be explored by using the movie data that does not precisely fit the exponential decay model. The first is the two audience model, which assumes the audience is a mix of a fast group with a slow group. The second is the growing audience, which assumes that word of mouth, causes the audience to grow. Both of these should be data driven. Early MML thoughts on these parts of the project are at the MML web page <http://www.math.fsu.edu/~bellenot/class/f04/cal3/project.html>

Sincerely,

Jacob and Johann Bernoulli  
Co-Chairmen

The POP model: It assumes the gross made in the  $n$ -th week is  $g_n = Cd^n$ . It assumes that the movie plays for ever, so the total gross is  $Cd + Cd^2 + Cd^3 + \dots = Cd/(1 - d)$ , which means the total gross is  $(1/(1 - d))$  times the gross for the opening week  $g_1$ . Eventually, the movie closes after  $N$  weeks but the error not going out to infinity is small, namely  $Cd^{N+1}/(1 - d)$ . After the movies run, one can estimate  $C$  and  $d$  by doing a linear regression (see the ExponentialDecay.txt file in our ti89 subdirectory).

The new MML model: uses a continuous probability density function

$$f(t) = \begin{cases} ke^{-kt} & t \geq 0 \\ 0 & t < 0 \end{cases}$$

and uses the integral

$$A \int_a^b f(t) dt = A(e^{-ka} - e^{-kb})$$

for the gross made between the times  $t = a$  and  $t = b$ . The constant  $A$  is the total gross of the movie. The constant  $k > 0$  represents the decaying interest in the publics need to see the film. The constant  $k$  is related to the "half-life" of the movie. One can obtain the POP model from the MML model.