DATA 609 - Final Project

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April 16, 2017

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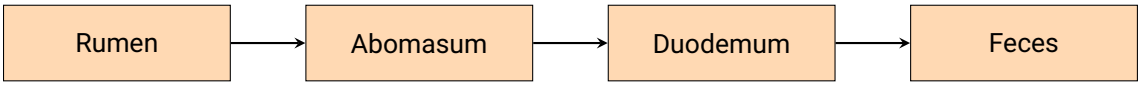
0.1 Textbook Part III:

0.1.1 The problem

The digestive processes of sheep can highlight the nutrionaly value in varied feeding schedules or varied food prepation. This is esspecially important when raising sheep for commercial purposes.

0.1.2 The digestive process

Sheep are a cud-chewing animal which means that unchewed food goes through a series of storage stomachs called the rumen and the reticulum. The process is illustrated below:



0.1.3 The experiment

The digestive process is most observable at the beginning and at the end, we can observer and control what goes in and what comes out.

0.1.4 The model

Suppose that at $t = 0$ a sheep is fed an amount R of food which goes immediately into its rumen. This food will pass gradually from the rumen through the abomasum into the duodenum. At any later time t we shall define:

$r(t)$ = the amount of food still in the rumen; $a(t)$ = the amount in the abomasum; $d(t)$ = the amount which by then has arrived in the duodenum.

So $r(0) = R$, $a(0)$ = $d(0)$ = 0, and, for all t>0, r(t) + a(t) + d(t) = R.

0.1.5 The assumptions

Two assumptions are made: (A) Food moves out of the rumen at a rate proportional to the amount of food in the rumen. Mathematically this says:

$r'(t) = -k_1 r(t)$

where k_1 is a positive proportionality constant.

(B) Food moves out of the abomasum at a rate proportional to the amout of food in the abomasum. Since at the same time food is moving into the abomasum at the rate given by Equation (2), the assumption says

(3) $a'(t) = k_1 r(t) - k_2 a(t)$