Figures for model selection lecture

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## Exponential smoothing methods

<table>
<thead>
<tr>
<th>Trend Component</th>
<th>Seasonal Component</th>
<th>N, N</th>
<th>A, N</th>
<th>M, N</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (None)</td>
<td>N, N</td>
<td>N, A</td>
<td>N, M</td>
<td></td>
</tr>
<tr>
<td>A (Additive)</td>
<td>A, N</td>
<td>A, A</td>
<td>A, M</td>
<td></td>
</tr>
<tr>
<td>A&lt;sub&gt;d&lt;/sub&gt; (Additive damped)</td>
<td>A&lt;sub&gt;d&lt;/sub&gt;, N</td>
<td>A&lt;sub&gt;d&lt;/sub&gt;, A</td>
<td>A&lt;sub&gt;d&lt;/sub&gt;, M</td>
<td></td>
</tr>
<tr>
<td>M (Multiplicative)</td>
<td>M, N</td>
<td>M, A</td>
<td>M, M</td>
<td></td>
</tr>
<tr>
<td>M&lt;sub&gt;d&lt;/sub&gt; (Multiplicative damped)</td>
<td>M&lt;sub&gt;d&lt;/sub&gt;, N</td>
<td>M&lt;sub&gt;d&lt;/sub&gt;, A</td>
<td>M&lt;sub&gt;d&lt;/sub&gt;, M</td>
<td></td>
</tr>
</tbody>
</table>

N, N: Simple exponential smoothing  
A, N: Holt’s linear method  
A<sub>d</sub>, N: Additive damped trend method  
M, N: Exponential trend method  
M<sub>d</sub>, N: Multiplicative damped trend method  
A, A: Additive Holt-Winters’ method  
A, M: Multiplicative Holt-Winters’ method
Example: Asian sheep

Numbers of sheep in Asia

millions of sheep


Year

Forecasting without forecasters  Motivation
Exponential smoothing

Forecasts from ETS(M,A,N)

```
fit <- ets(livestock)
fcast <- forecast(fit)
plot(fcast)
```
Example: Cortecosteroid sales

Monthly cortecosteroid drug sales in Australia

[Graph showing monthly cortecosteroid drug sales in Australia from 1995 to 2010]
Exponential smoothing

Forecasts from ETS(M,Md,M)

Year

Total scripts (millions)