

ESS 575: Probability Lab 2 - Probability Distributions

Team England

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Question 1

We commonly represent the following general framework for linking models to data:

$$[y_i \mid g(\theta, x_i), \sigma^2] \tag{1}$$

which represents the probability of obtaining the observation y_i given that our model predicts the mean of a distribution $g(\theta, x_i)$ with variance σ^2 . Assume we have count data. What distribution would be a logical choice to model these data? Write out a model for the data.

```
# lambda
lambda <- seq(0.25, 4, 0.25)

# time
t <- seq(1, 30, 1)

# x
x <- numeric(length(t))
x[1] <- 0.01

# set up function
fn_x_t <- function(x, t, lambda) {
  x_t <- lambda * x[t-1] * (1 - x[t-1])
  return(x_t)
}

# set up plot grid
plts <- list()
```

```

#loop through lambda values
for (my_l in 1:length(lambda)) {
  # assign values of x by t
  for (my_t in 2:length(t)) {
    x[my_t] <- fn_x_t(x, my_t, lambda[my_l])
  }

  # set up temp data
  dta <- data.frame(
    t
    , x
  )
  # plot
  plts[[my_l]] <-
    ggplot(dta, aes(x = t, y = x)) +
      geom_line(
        size = 1
        , alpha = 0.8
      ) +
      labs(
        title = bquote(paste(
          lambda
          , " = "
          , .(lambda[my_l])
        ))
      ) +
      xlab("time") +
      ylab("x") +
      theme_bw() +
      theme(
        legend.position="none"
        , plot.title = element_text(size = 9)
        , axis.text = element_text(size = 8)
        , axis.title = element_text(size = 8)
      )
}

# pass plots to grid extra package
do.call(gridExtra::grid.arrange, plts)

```