R Notebook

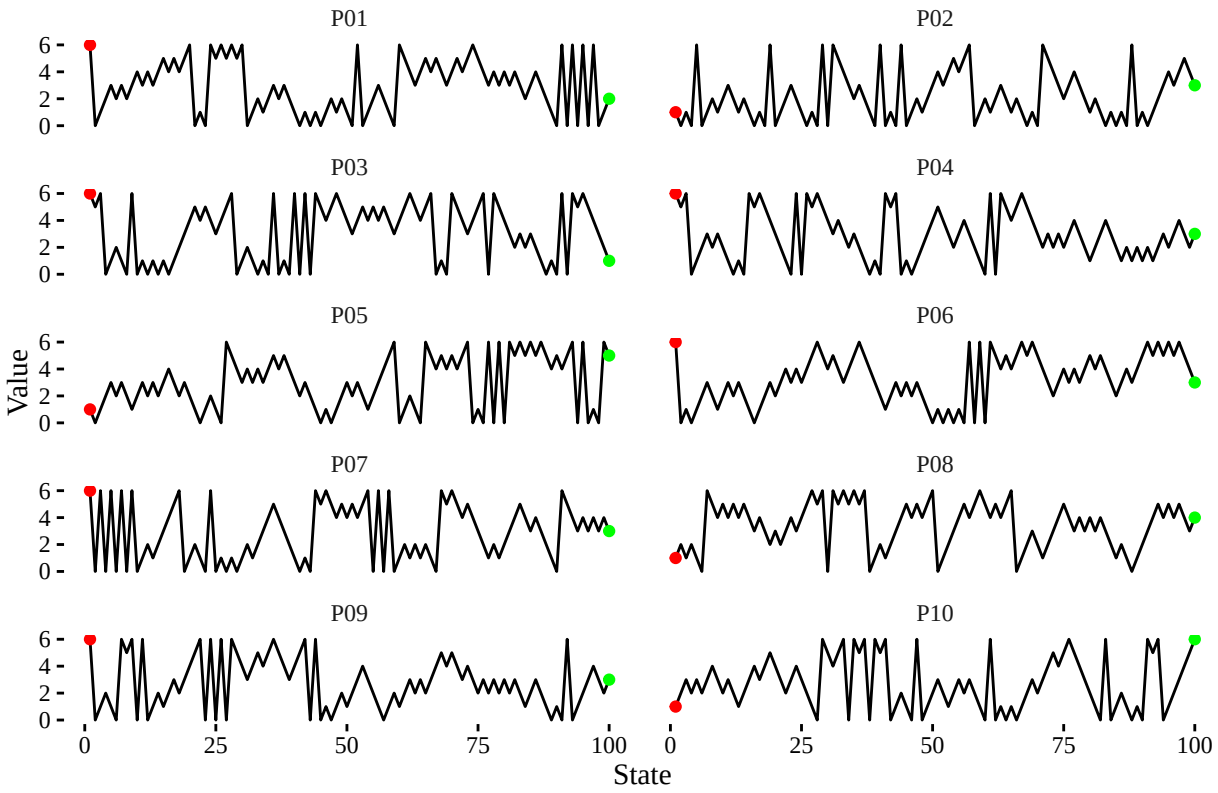
Consider the simple symmetric random walks on $\mathbb{Z}/7$ and $\mathbb{Z}$ with $X_0 = 0$. Using a random number generator make graphs of ten paths describing realizations of the Markov chains from $l = 0$ to $l = 100$.

```
path <-  data.frame(
  matrix(
    vector(),
    101,
    11,
    dimnames=list(
      c(),
      c("l", "P01", "P02","P03", "P04","P05",
        "P06","P07", "P08","P09", "P10"))
    ),
  stringsAsFactors=F)

path[1,1:11] <- 0
for(i in 1:100){
  zi = sample(c(-1,1),10, replace = TRUE)
  path[i+1,1] = i
  for(j in 2:11){
    path[i+1,j] = (zi[j-1] + path[i,j]) %% 7
    }
}
path <- filter(path[2:101,])
```

```
path2 <- path %>%
  gather(value = n, key = path, -l) %>%
  mutate(maxmin = case_when((.$l == 100) ~ "2",
                            (.$l == 1) ~ "1"))
```

```
ggplot(data = path2,
       aes(x = l, y = n)) +
  geom_line() +
  geom_point(aes(colour = maxmin)) +
  scale_color_manual(values = c("red","green")) +
  facet_wrap(~ path, ncol = 2, nrow = 5) +
  theme_tufte() +
  theme(legend.position = "") +
  labs(x = "State",
       y = "Value",
       title = "Simple Random Walks on Z/7")
```


Simple Random Walks on Z/7
P01
P02
P03
P04
P05
P06
P07
P08
P09
P10
Value
State
0
2
4
6
0
25
50
75
100