Programming: Practical 2b solutions

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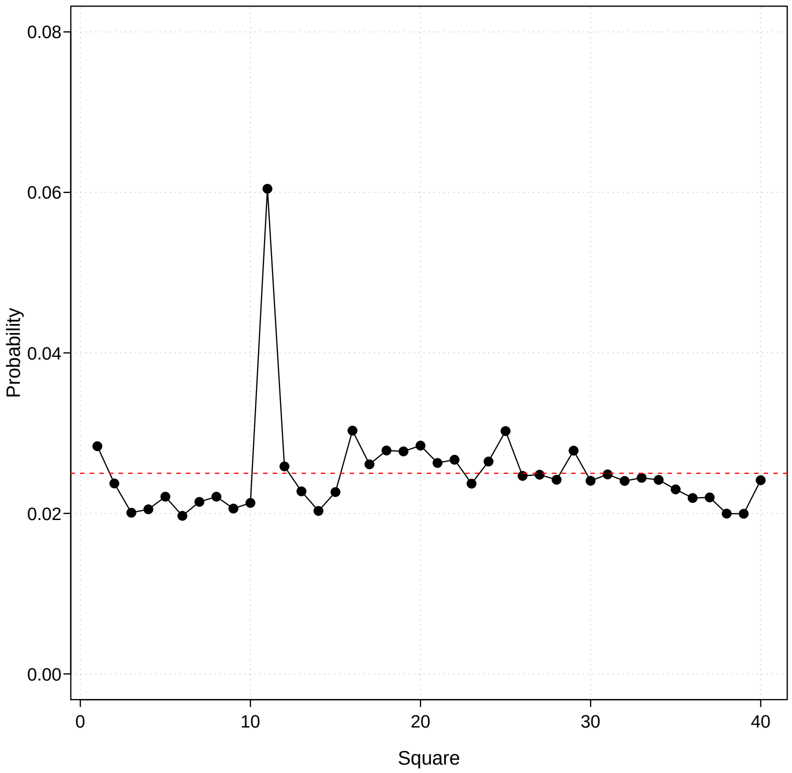

Figure 1: Distribution of resting places in a game of monopoly using 5×10^4 rolls.

```r
## Dice function
RollTwoDiceWithDoubles = function(current) {
    df = data.frame(d1 = sample(1:6, 3, replace = TRUE),
        d2 = sample(1:6, 3, replace = TRUE))
    df$Total = apply(df, 1, sum)
    df$IsDouble = df$d1 == df$d2
    if (df$IsDouble[1] & df$IsDouble[2] & df$IsDouble[3]) {
        current = 11  #Go To Jail
    } else if (df$IsDouble[1] & df$IsDouble[2]) {
        current = current + sum(df$Total[1:2])
    } else {
        current = current + df$Total[1]
    }
    return(current)
}
```

```r
## Helper function to avoid code replication
CheckState = function(current) {
    if (current > 40) {
        current = current - 40
    } else if (current < 1) {
        current = current + 40
    }
    return(current)
}
```

```
UpdateStateVector = function(current, move, landings) {
    if (move != current) {
        landings[current] = landings[current] + 1
    }
    return(landings)
}
```

```
CommunityChest = function(current) {
    u = runif(1)
    goto = current  #Default. Do nothing
    if (u < 1/16) {
        goto = 1  #Go
    } else if (u < 2/16) {
        goto = 11  #Jail
    } else if (u < 3/16) {
        goto = 2  #Old Kent Rd
    } else if (u < 4/16) {
        goto = Chance(current)
    }
    return(goto)
}
Chance = function(current) {
    u = runif(1)
    goto = current  #Default. Do nothing
    if (u < 1/16) {
        goto = 1  #Go
    } else if (u < 2/16) {
        goto = 25  #Tra Square
    } else if (u < 3/16) {
        goto = 12  #Pall Mall
    } else if (u < 4/16) {
        goto = 11  #Jail
    } else if (u < 5/16) {
        goto = 16  #Mary' Stat
    } else if (u < 6/16) {
        goto = 40  #Mayfair
    } else if (u < 7/16) {
        goto = CheckState(current - 3)  #Must check, since goto maybe negative!
    } else if (u < 8/16) {
        if (current > 29 | current < 13) {
            goto = 13
        } else {
            goto = 29
        }
    }
    return(goto)
}
```

```
SimulateMonopoly = function(no_of_turns) {
    landings = numeric(40)
    ## Start GO
    current = 1
    for (i in 1:no_of_turns) {
        current = RollTwoDiceWithDoubles(current)
        current = CheckState(current)
        landings = UpdateStateVector(current, -1, landings)
        if (current == 3 | current == 18 | current ==
            34) {
            # Community Chest
            move = CommunityChest(current)
            landings = UpdateStateVector(move, current,
                landings)
            current = move
        } else if (current == 8 | current == 23 | current ==
            37) {
            # Chance
            move = Chance(current)
            landings = UpdateStateVector(move, current,
                landings)
            current = move
        }
        ## Go To Jail. Chance could also send you here by
        ## going back three places
        if (current == 31) {
            current = 11
            landings = UpdateStateVector(current, -1,
                landings)
        }
    }
    return(landings)
}
```

Neater Solutions

Some of the functions could be simplified.

```
## Rather than if statements, just work to mod 40
CheckState = function(current) {
    current = current%%40
    if (current == 0)
        current = 40
    return(current)
}
```

```
## Use the sample command to move square
CommunityChest = function(current) {
    u = runif(1)
    goto = current  #Default. Do nothing
    if (u < 3/16) {
        goto = sample(c(1, 11, 2), 1)
    } else if (u < 4/16) {
        goto = Chance(current)
    }
    return(goto)
}
```

```
## Use the sample command to move square
Chance = function(current) {
    u = runif(1)
    goto = current  #Default. Do nothing
    if (u < 6/16) {
        goto = sample(c(1, 25, 12, 11, 16, 50), 1)
    } else if (u < 7/16) {
        goto = CheckState(current - 3)  #Must check, since goto maybe negative!
    } else if (u < 8/16) {
        if (current > 29 | current < 13) {
            goto = 13
        } else {
            goto = 29
        }
    }
    return(goto)
}
```