Data 605 Homework 9

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Week 9 Homework

Question #11 Page 363:

A tourist in Las Vegas was attracted by a certain gambling game in which the customer stakes 1 dollar on each play; a win then pays the customer 2 dollars plus the return of her stake, although a loss costs her only her stake. Las Vegas insiders, and alert students of probability theory, know that the probability of winning at this game is 1/4. When driven from the tables by hunger, the tourist had played this game 240 times. Assuming that no near miracles happened, about how much poorer was the tourist upon leaving the casino? What is the probability that she lost no money?

#1

Work and Answer

First, I established the givens of the problem. I calculated the expected amount won after 1 game then 240 games. I then calculated the amount of wins you would need to break even on playing.

```r
#prob of winning

win_prob=0.25
lose_prob=1-win_prob

#exp val 1 game
exp_1_game=(win_prob*3)+(lose_prob*-1)

#after 240 games

exp_240_gms=exp_1_game*240

#num wins to break even
break_even=240 %/% 3

cat("The expected value of money gained in the casino game is",exp_240_gms, ". This indicates that the
```

```
## The expected value of money gained in the casino game is 0 . This indicates that the tourist is expe
```

```r
#binom distr prob breaking even
break_even_prob= choose(240,break_even)*(win_prob ^ break_even)* (lose_prob ^ (240 - break_even))

cat("The probability that the tourist lost no money is",break_even_prob, "or", break_even_prob*100,"%.
```

```
## The probability that the tourist lost no money is 0.0008436991 or 0.08436991 %.
```

#2

Question:

Calculate the expected value and variance of the binomial distribution using the moment generating function.

Work and Answer:

```r
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
#binomial moment generating funct

mgf_binom= expression((win_prob*exp(t)+lose_prob)^break_even)

#first derivative @t=0

dx_binom= D(mgf_binom, "t")

dx_binom_fn= function(t) eval(dx_binom)

dx_binom_exp= dx_binom_fn(0)

#2nd derivative @t=0
dx2_binom=D(dx_binom,"t")

dx2_binom_fn= function(t) eval(dx2_binom)

second_moment_binom= dx2_binom_fn(0)

#varience
var_binom= second_moment_binom-dx_binom_exp^2

cat("The expected value is", dx_binom_exp, ".\n")
```

```
## The expected value is 20 .
```

```r
cat("The variance value is", var_binom, ".\n")
```

```
## The variance value is 15 .
```

#3

Question

Calculate the expected value and variance of the exponential distribution using the moment generating function.

Work and Answer:

```r
#exp moment generating funct

lambda=1

mgf_exp= expression(lambda / (lambda - t))

#first derivative @t=0

dx_exp= D(mgf_exp, "t")

dx_exp_fn= function(t) eval(dx_exp)

dx_exp_exp= dx_exp_fn(0)

#2nd derivative @t=0
dx2_exp=D(dx_exp,"t")

dx2_exp_fn= function(t) eval(dx2_exp)

second_moment_exp= dx2_exp_fn(0)

#varience
var_exp= second_moment_exp-dx_exp_exp^2

cat("The expected value is", dx_exp_exp, ".\n")
```

```
## The expected value is 1 .
```

```r
cat("The variance value is", var_exp, ".\n")
```

```
## The variance value is 1 .
```