

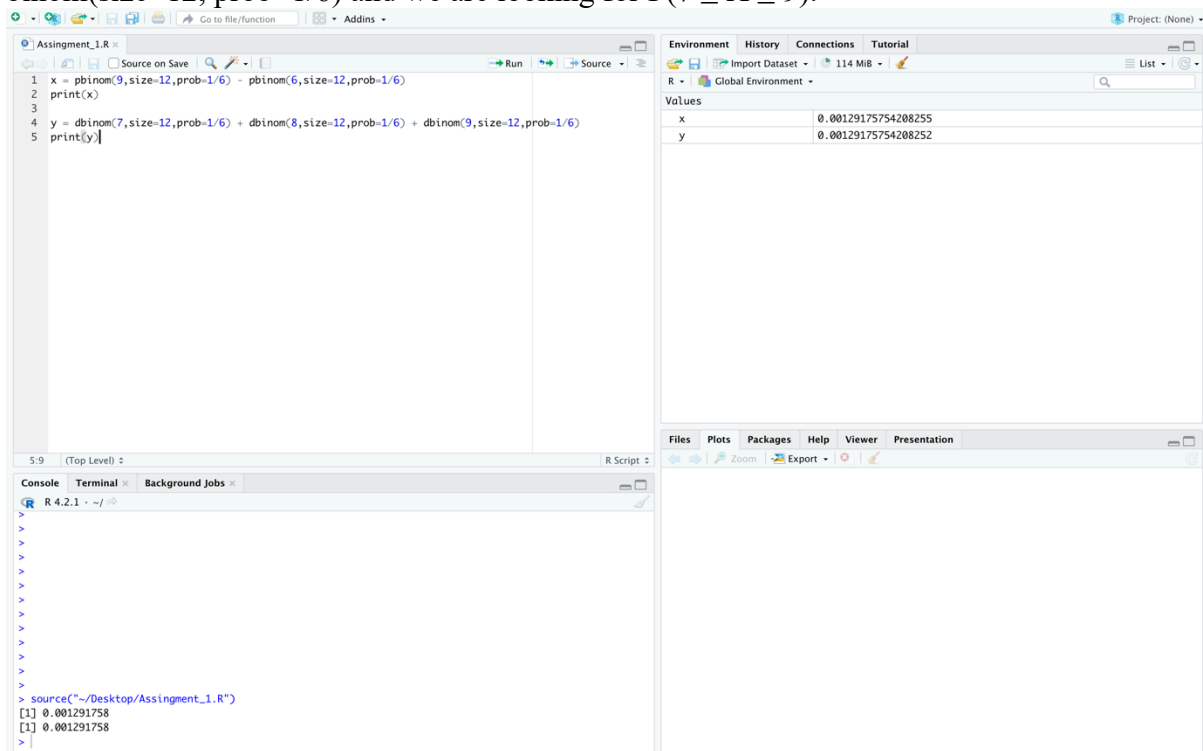
Probability And Statistics

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Class: 3CO1

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1. Roll 12 dice simultaneously, and let X denotes the number of 6's that appear. Calculate the probability of getting 7, 8 or 9, 6's using R. (Try using the function pbinom; If we set $S = \{\text{get a 6 on one roll}\}$, $P(S) = 1/6$ and the rolls constitute Bernoulli trials; thus $X \sim \text{binom}(\text{size}=12, \text{prob}=1/6)$ and we are looking for $P(7 \leq X \leq 9)$.



The screenshot shows the R Studio environment. The script editor contains the following R code:

```
1 x = pbinom(9,size=12,prob=1/6) - pbinom(6,size=12,prob=1/6)
2 print(x)
3
4 y = dbinom(7,size=12,prob=1/6) + dbinom(8,size=12,prob=1/6) + dbinom(9,size=12,prob=1/6)
5 print(y)
```

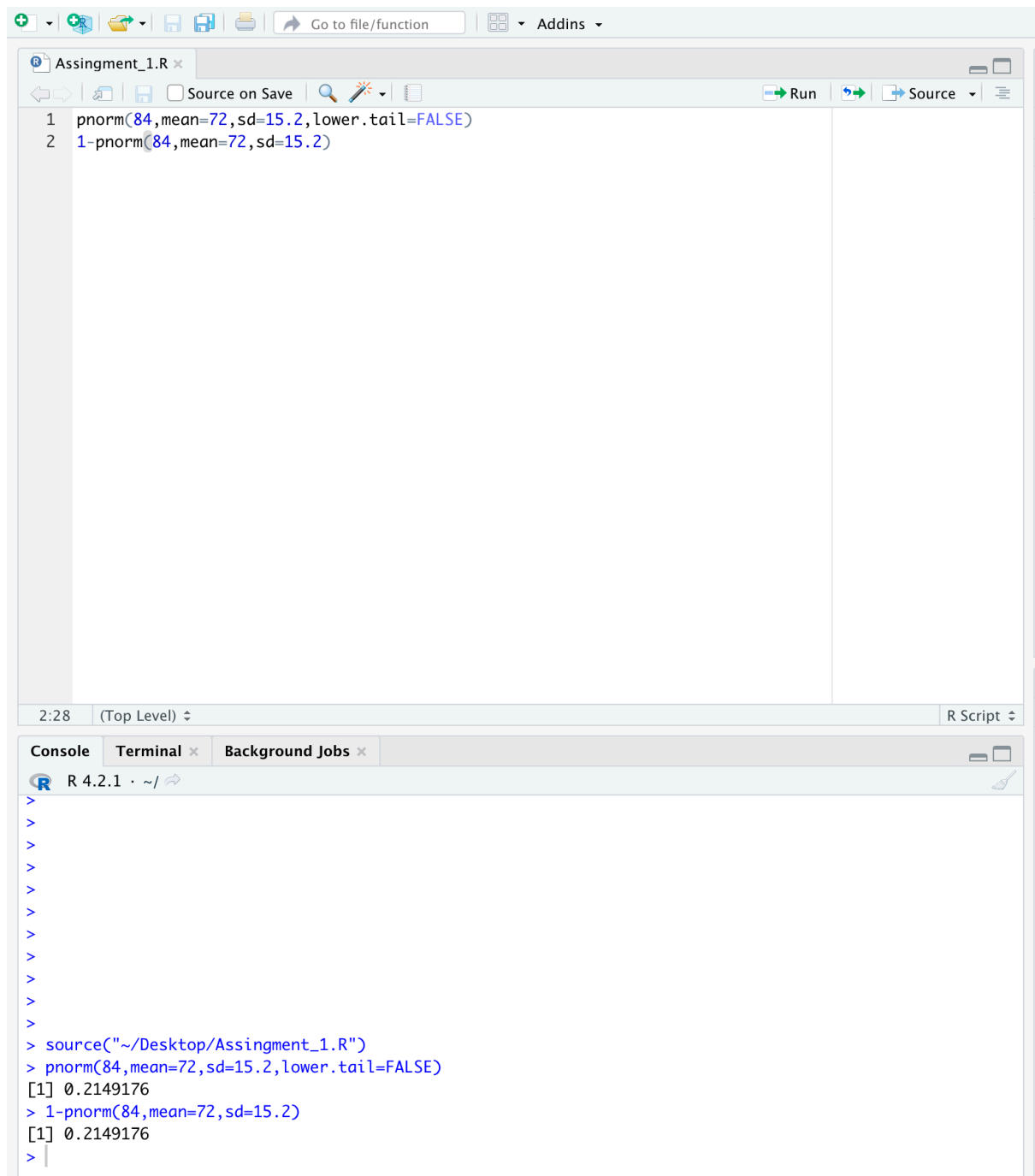
The Environment pane on the right shows the values of the variables:

Variable	Value
x	0.00129175754208255
y	0.00129175754208252

The Console pane at the bottom shows the output of the code:

```
> source("~/Desktop/Assignment_1.R")
[1] 0.001291758
[1] 0.001291758
>
```

2. Assume that the test scores of a college entrance exam fits a normal distribution. Furthermore, the mean test score is 72, and the standard deviation is 15.2. What is the percentage of students scoring 84 or more in the exam?



The screenshot shows the RStudio environment. The script editor at the top contains two lines of R code:

```
1 pnorm(84,mean=72,sd=15.2,lower.tail=FALSE)
2 1-pnorm(84,mean=72,sd=15.2)
```

The console at the bottom shows the execution of these commands:

```
>
>
>
>
>
>
>
>
>
> source("~/Desktop/Assingment_1.R")
> pnorm(84,mean=72,sd=15.2,lower.tail=FALSE)
[1] 0.2149176
> 1-pnorm(84,mean=72,sd=15.2)
[1] 0.2149176
>
```

The console output confirms that both methods yield the same result: 0.2149176.

3. On the average, five cars arrive at a particular car wash every hour. Let X count the number of cars that arrive from 10AM to 11AM, then $X \sim \text{Poisson}(\lambda = 5)$. What is probability that no car arrives during this time. Next, suppose the car wash above is in operation from 8AM to 6PM, and we let Y be the number of customers that appear in this period. Since this period covers a total of 10 hours, we get that $Y \sim \text{Poisson}(\lambda = 5 \times 10 = 50)$. What is the probability that there are between 48 and 50 customers, inclusive?

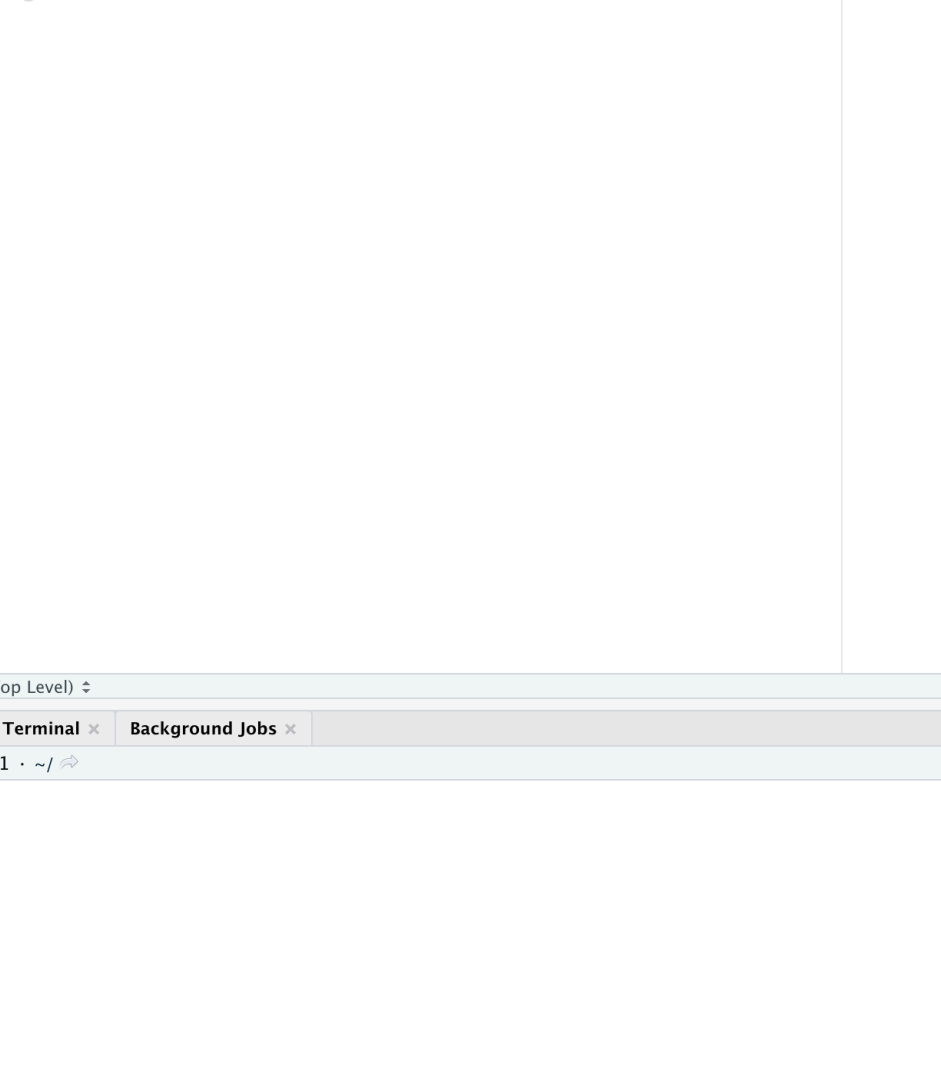
The screenshot shows the RStudio environment. The top toolbar includes icons for adding files, saving, printing, navigating to a file/function, and running code. Below the toolbar, the script editor displays two lines of R code:

```
1 dpois(0, lambda = 5)
2 ppois(50, lambda=50) - ppois(47, lambda=50)
```

The status bar at the bottom indicates the current position is 2:42 at the Top Level. The bottom pane contains three tabs: Console, Terminal, and Background Jobs. The Console tab is active, showing the execution of the code from the script above it. The output consists of two lines:

```
> 
> 
> 
> 
> 
> 
> 
> 
> 
> 
> 
> dpois(0, lambda = 5)
[1] 0.006737947
> ppois(50, lambda=50) - ppois(47, lambda=50)
[1] 0.1678485
>
```

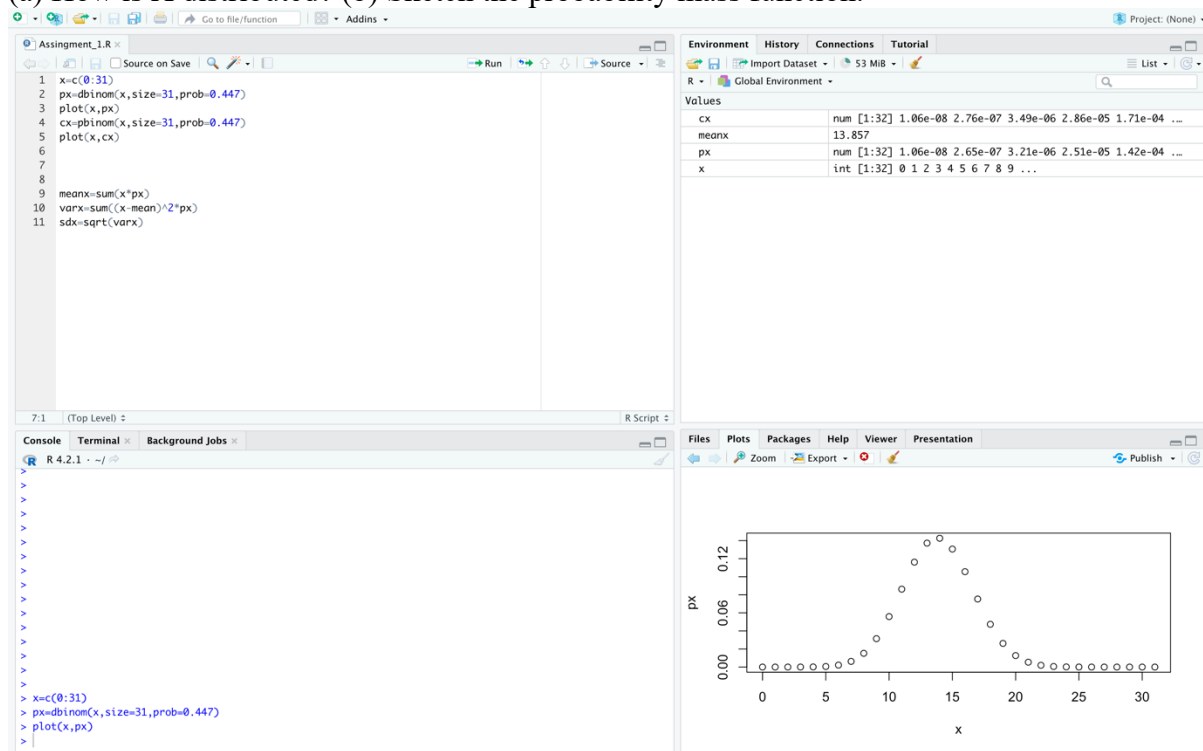
4. Suppose in a certain shipment of 250 Pentium processors there are 17 defective processors. A quality control consultant randomly collects 5 processors for inspection to determine whether or not they are defective. Let X denote the number of defectives in the sample. Find the probability of exactly 3 defectives in the sample, that is, find $P(X = 3)$.



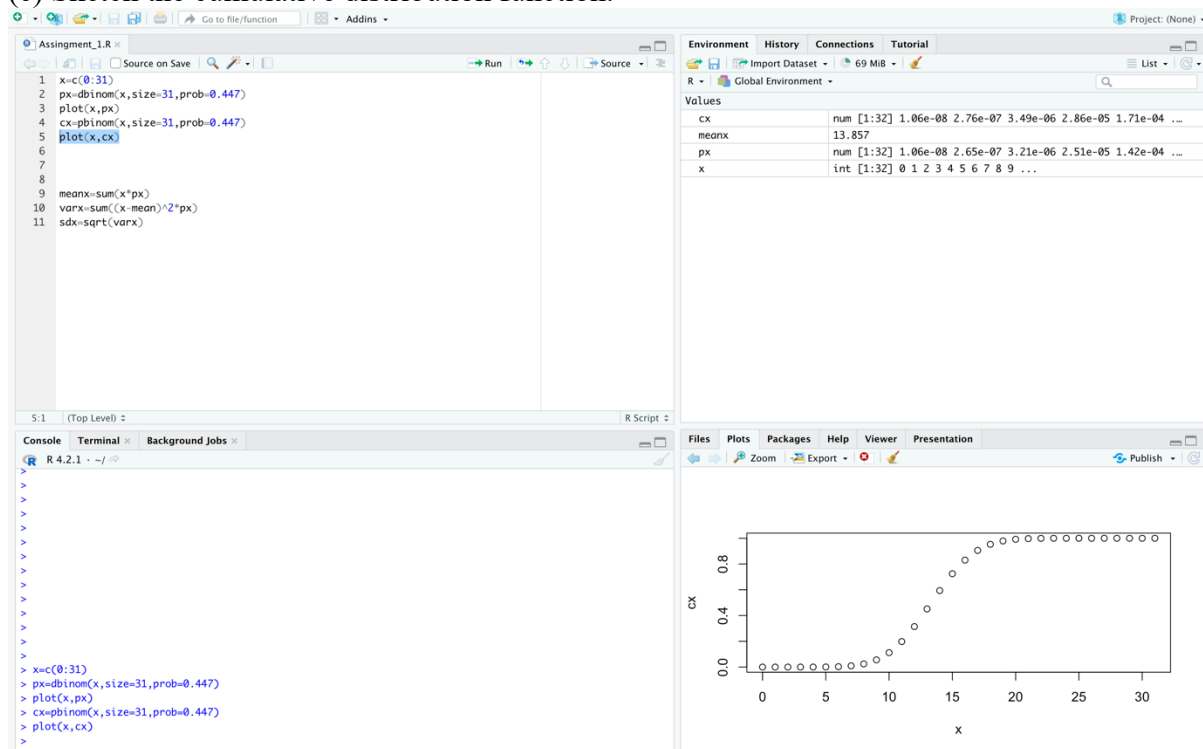
The screenshot displays the RStudio environment. The top toolbar includes icons for file operations (add, open, save, print) and a 'Go to file/function' search bar. The main editor window, titled 'Assingment_1.R', contains a single line of R code: `1 dhyper(3,m=17,n=233,k=5)`. The bottom panel is divided into three tabs: 'Console', 'Terminal', and 'Background Jobs'. The 'Console' tab is active, showing the R prompt `>` and the output of the executed code: `[1] 0.002351153`. The status bar at the bottom indicates the R version is 4.2.1 and the current file is `~/`.

5. A recent national study showed that approximately 44.7% of college students have used Wikipedia as a source in at least one of their term papers. Let X equal the number of students in a random sample of size $n = 31$ who have used Wikipedia as a source.

(a) How is X distributed? (b) Sketch the probability mass function.



(c) Sketch the cumulative distribution function.



(d) Find mean, variance and standard deviation of X.

