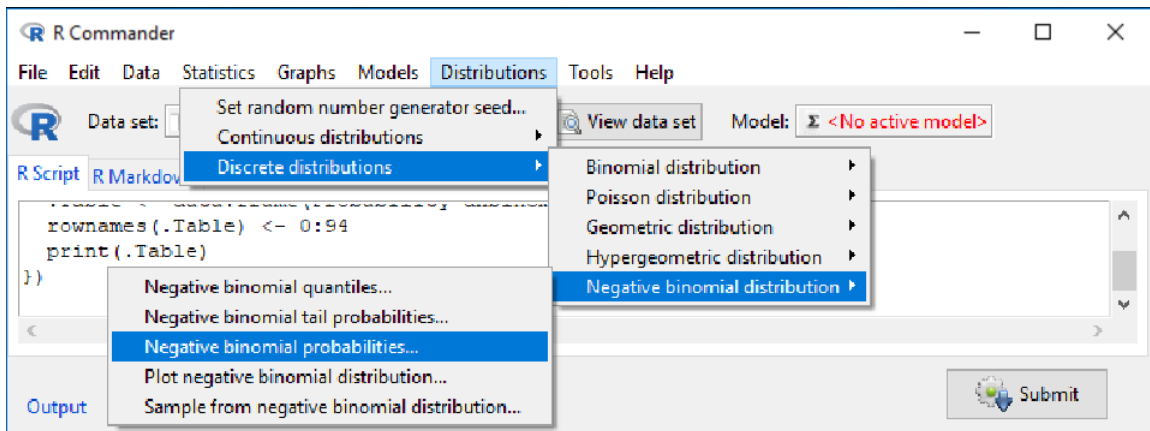


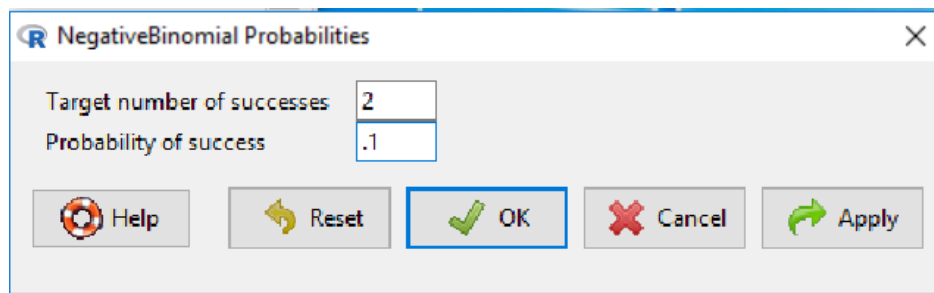
## Negative Binomial Distribution

**Example:** It is reported that 10% of the apples from the Apple Farm are bad. If apples are randomly selected from this farm one after another, what is the probability that the 10<sup>th</sup> apple selected will be the 2<sup>nd</sup> bad apple selected?

- 1.) In R Commander, select **Distributions, Discrete Distributions, Negative binomial distribution, and Negative binomial probabilities.**



- 2.) Enter information into the Negative binomial probabilities dialogue box. The number of successes equals 2 and the probability of success equals .1.



- 3.) R displays a list of values similar to the one shown below. Find the number of successes (10 in this case) and read the probability. **\*\*Note that the Negative Binomial random variable takes on number failures before the r<sup>th</sup> success\*\*** So, the answer to this problem is around 0.0387 that is probability next to number 8 in the R output. It is the probability of observing 8 failures before the 2<sup>nd</sup> success.

```

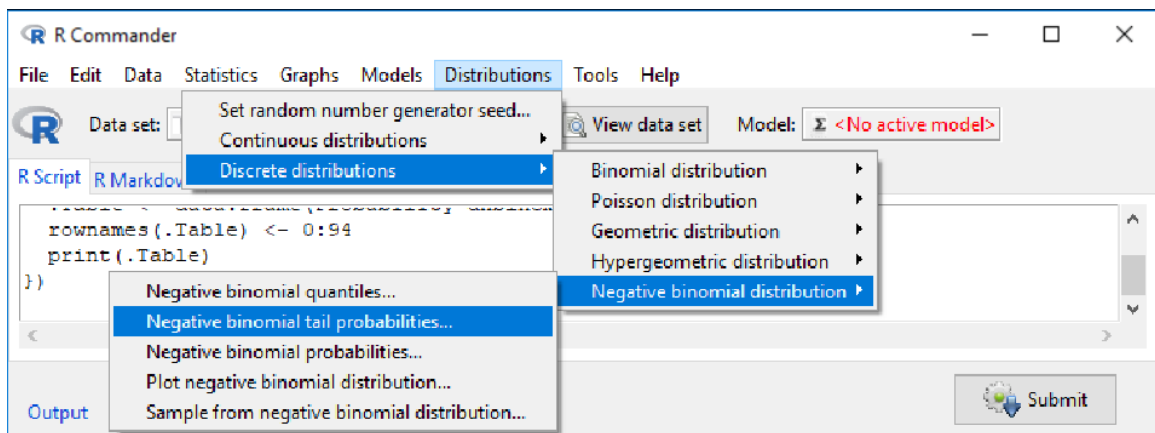
rownames(.Table) <- 0:94
print(.Table)
})

```

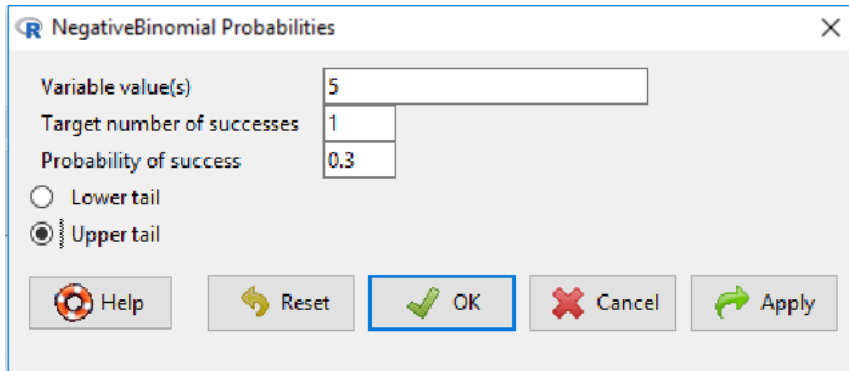
	Probability
0	0.01000000000
1	0.01800000000
2	0.02430000000
3	0.02916000000
4	0.03280500000
5	0.03542940000
6	0.03720087000
7	0.03826375200
8	0.03874204890
9	0.03874204890

**Tail Probability Example:** If 30% of the cars passing your house are red what is the probability that more than 5 cars will pass before you observe the first red one? (Geometric Distribution: a special case of Negative Binomial Distribution.)

- 1.) In R Commander, select **Distributions, Discrete Distributions, Negative binomial distribution, Negative binomial tail probabilities**



- 2.) Enter information into the Negative binomial probabilities dialogue box. The number of successes equals 1 and the probability of success equals .3. Since more than 5 cars is requested, the variable value is 5 and Upper tail probability option should be checked. (If Lower tail is selected, then the probability would be  $P(X \leq 5)$ .)



- 3.) Results should indicate approximately an 11% chance that more than 5 car will pass before seeing the first red one.

R output:

```
> pnbinom(c(5), size=1, prob=0.3, lower.tail=FALSE)
[1] 0.117649
```