BINF 6310 | Lab 2 | Jon Lee

title: “R Notebook” output: html_notebook — Question 1

In a population, there is 1/3 chance that a given person has a mutation in some gene

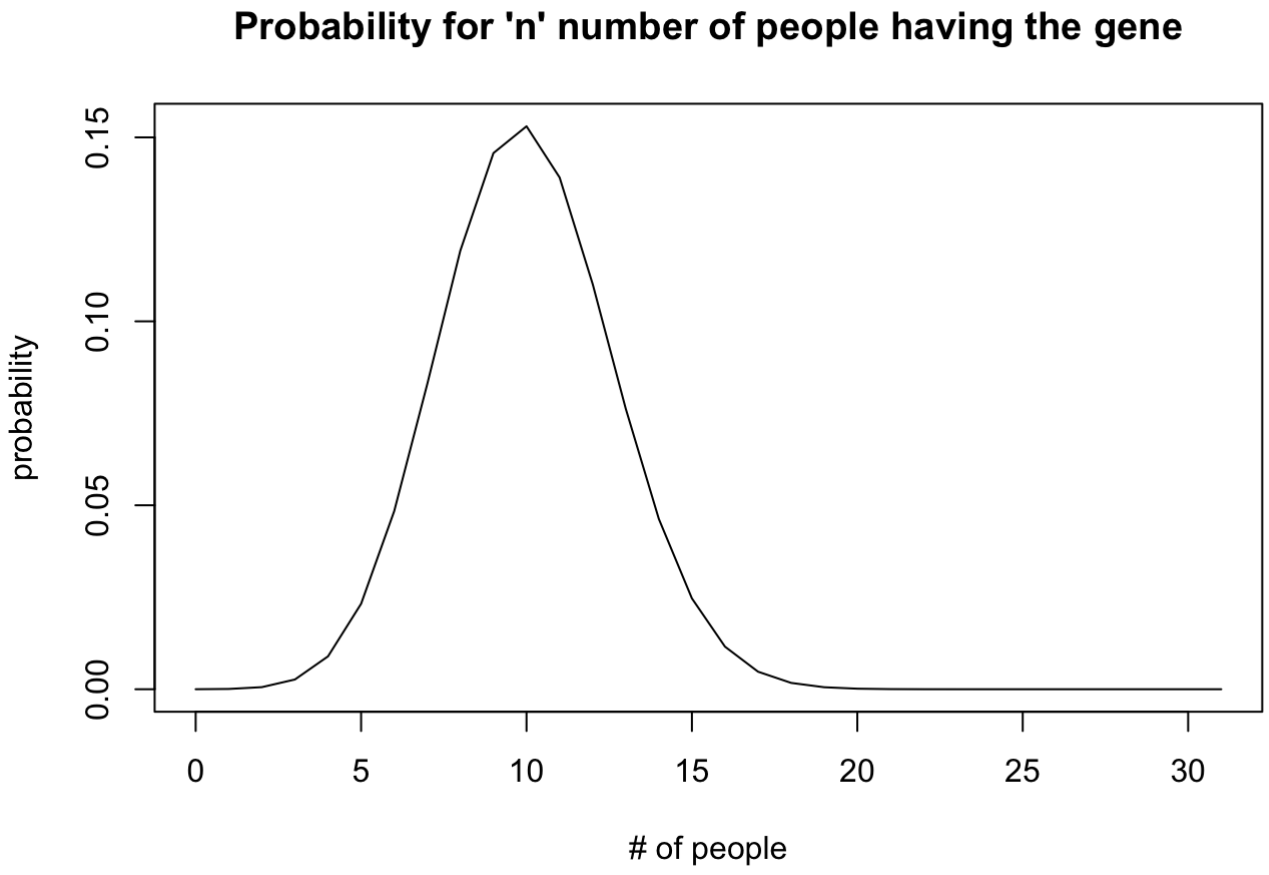
You sample 30 people; what are the odds that exactly 12 of the people have the mutation?

```
dbinom(12, 30, 1/3)
```

```
## [1] 0.1101246
```

In R plot a probability density function (with dbinom) that shows the distribution for observing exactly (0,1,2,…30) people with the mutation.

```
people <- seq(0,31,1)
dist <- dbinom(people, 30, 1/3)
plot(people, dist, type = "l", xlab = "# of people", ylab = "probability", main = "Proba
bility for 'n' number of people having the gene")
```



What is the mean and variance for the expected number of people with the mutation.

```
geneMean <- 30*(1/3)
geneMean
```

```
## [1] 10
```

```
geneVar <- 30*(1/3)*(2/3)
geneVar
```

```
## [1] 6.666667
```

Question 3

(3A) Use the rbiom function to simulate 1,000 experiments in which 10,000 patients are sampled with a 1/2 chance of seeing a mutation. (You should get 1,000 numbers back with each # the # of patients from the 10,000 that had the mutation…)

(What is the one line of r-code that would produce myVals?)

```
myVals <- rbinom(1000, 10000, 0.5)
myVals
```

```
##    [1] 4945 4966 4992 5050 5027 4967 4968 4995 4937 5124 5086 5045 5022 5097
##   [15] 4986 4963 5019 4956 5031 5086 5080 4983 4971 5068 4979 4986 4984 5030
##   [29] 4974 5023 5054 5024 5003 5008 5030 5051 5034 4977 4988 4985 4985 5087
##   [43] 4903 5063 5009 4984 4995 4934 5015 4991 4970 5028 5092 4999 4915 4994
##   [57] 5077 4982 5058 5009 5100 5029 4987 4999 4996 5010 4977 4942 5018 4900
##   [71] 5002 4986 4966 4961 5018 5062 5051 4899 5054 5096 5093 4961 5020 5012
##   [85] 5009 5056 5006 4994 5010 4923 5014 4994 4978 5004 5006 5008 5026 4992
##   [99] 4894 4943 4943 4961 5021 4958 5021 5047 5004 5037 4939 5046 4957 5035
##  [113] 4981 4956 4940 5010 4943 5048 5017 5087 4930 4999 5033 5085 4983 4940
##  [127] 4928 4939 4904 5100 5058 5005 4976 4982 5025 4971 5016 4898 4885 4994
##  [141] 5023 4998 5082 5055 5009 4943 4899 5019 4964 5008 4982 4995 4996 5084
##  [155] 5077 5020 4996 5006 4944 4931 4935 5017 4984 4964 5009 5052 5019 5029
##  [169] 4973 5133 5154 5013 5033 5035 4917 5039 4982 5058 4949 4852 5002 4973
##  [183] 4892 4968 4989 4924 5004 4993 4957 5033 5009 5050 5032 4966 4999 5108
##  [197] 5040 4961 4994 4941 5017 4982 5000 5008 5004 4983 4987 5014 4948 5001
##  [211] 5023 5066 5103 5022 4997 4950 5004 4939 5016 5081 4970 5093 5026 5044
##  [225] 4935 4976 5009 5022 4983 5024 4994 5008 4950 4965 5040 4943 5004 4994
##  [239] 5029 5031 5066 5006 4943 4984 5019 5015 4954 5009 5032 4997 4955 5022
##  [253] 5021 5018 4999 4898 4962 5016 4937 5006 5005 4987 4982 5033 5064 5007
##  [267] 4917 4940 4941 5020 5011 4950 4960 5033 4969 5058 4991 4992 4968 4967
##  [281] 5052 4966 4953 5073 4970 5025 5069 4953 4931 4968 5050 5005 5005 5001
##  [295] 4914 5084 4938 5024 5093 4992 4996 5009 5024 4992 4911 4956 4991 4993
##  [309] 4996 4967 4923 5017 5014 4992 4959 5016 5013 5034 4977 5004 5018 5062
##  [323] 5025 5017 4976 5092 5039 5029 4952 5045 4944 5031 4987 4948 4958 4964
##  [337] 4956 5008 5064 4921 4994 4990 4990 5078 5057 4965 5050 4939 5063 5037
##  [351] 4952 4998 4977 5084 4928 5017 4923 4988 5009 5009 5080 5023 5006 5015
##  [365] 5049 4943 5008 5102 4995 5077 4957 5002 4973 5000 5006 4998 4988 4972
##  [379] 5097 5047 5035 4973 4958 5069 4983 5035 5096 5003 5123 5035 4926 5055
##  [393] 4938 5032 4922 4943 4932 4899 5003 5002 5030 4988 4963 5095 4931 5007
##  [407] 4980 5083 4999 5006 4993 5006 4946 5047 4989 4941 5003 4951 5037 5059
##  [421] 5008 4927 4984 4997 4939 5019 5057 5069 5043 4946 4922 5002 5027 5058
##  [435] 4970 4972 5082 4991 5032 5031 5030 5065 4948 4937 5068 5076 5034 4997
##  [449] 5086 5041 5048 5021 5004 4986 5022 4950 5040 5013 4959 4996 5041 5028
##  [463] 5061 5027 4997 4963 5007 4973 4988 4955 4963 5039 4963 4989 5011 5025
##  [477] 5032 4997 5053 5062 5058 5006 4996 5007 5028 4950 5033 5051 4995 5014
##  [491] 5020 5023 5063 4952 5011 5062 5020 4881 4978 4960 5051 5031 5014 4975
##  [505] 5010 4948 4981 4910 5037 4963 4919 4964 5031 5045 5040 5004 5032 5010
##  [519] 4940 5007 4981 4960 4951 4929 5027 4958 4981 4910 4943 5033 5004 5001
##  [533] 4987 4996 5086 5044 4991 4920 5004 4938 4981 4975 5041 5004 4949 4942
##  [547] 5062 5026 4956 5025 5011 5022 5013 4997 5071 4901 4927 5001 4938 4942
##  [561] 5015 4995 4929 5052 5020 4929 4969 5012 4969 5008 5014 4976 4959 5053
##  [575] 4995 4989 5085 5070 4993 4992 4990 5009 5017 4942 4987 5025 4972 4995
##  [589] 5084 5032 4979 4864 4946 5002 4981 4993 5048 4919 5027 4914 5004 4984
##  [603] 5034 5009 4961 4941 4966 4911 5008 5077 5033 4975 4933 4980 5018 4987
##  [617] 5065 4990 4968 5087 4979 4975 4992 5066 5023 4988 5033 5024 5019 5002
##  [631] 5077 5018 4960 4925 4981 4903 4966 4983 4971 5002 5047 4908 5050 5059
##  [645] 5038 5032 4950 4966 4952 5048 5013 5003 4911 5027 4969 5015 5021 5046
##  [659] 4994 4964 5045 4954 5065 5036 5011 4966 4943 4971 4964 4970 4920 4963
##  [673] 5080 4937 4966 5045 5014 5014 5017 4993 4968 4901 4943 5047 4978 5131
##  [687] 5049 5028 4902 4907 5116 4955 5016 4978 5086 4947 5091 4939 5076 5092
##  [701] 4999 5042 4982 4940 4976 4908 5026 5094 4981 5118 4988 5000 4850 4949
##  [715] 4960 4961 5043 4968 4917 4948 5051 4952 4894 5002 4982 5051 5011 4941
##  [729] 4958 5081 4988 5024 5071 4983 4991 4948 5007 5006 5032 4984 4941 5027
```

```
##  [743] 5034 5045 5031 5019 4978 4988 5062 5018 4973 4969 4979 4990 5063 5003
##  [757] 5007 5012 5040 4926 5035 5040 5007 4935 4939 4961 4919 4994 5029 4970
##  [771] 5056 4945 4982 4986 5028 4974 5007 4990 5026 5047 4962 4962 4921 4950
##  [785] 4900 4884 5011 4996 5010 4975 4945 5020 5018 5046 5023 4959 5063 5044
##  [799] 4976 4905 4889 5017 5009 5034 5036 4948 5069 4974 5024 5020 5036 5105
##  [813] 5069 5007 4925 4944 5029 4966 4991 5001 4993 5021 4927 5017 5049 4982
##  [827] 4965 4951 5094 4993 4946 5000 5088 4965 4900 5018 5002 5104 5009 4941
##  [841] 4923 5029 5015 4991 4984 4939 5068 5076 5118 5006 5018 4979 4997 4980
##  [855] 5027 5024 5073 5034 5028 4970 4983 4942 4983 5024 4958 5019 4975 4963
##  [869] 4986 4964 5010 5021 5045 5043 5020 4937 5032 5039 4910 5045 5035 4988
##  [883] 5025 4988 5011 5070 5058 4992 5037 5045 5088 5017 4947 4988 4966 5033
##  [897] 4971 4922 5072 5047 4917 5034 5038 5084 4992 5025 4974 5084 5078 4929
##  [911] 5122 5009 5033 4942 5033 5031 4983 4946 4977 5017 5099 4960 5023 4963
##  [925] 4932 5033 4965 5017 4990 5001 5051 4966 5013 4984 4995 4973 5010 4998
##  [939] 4993 4987 5003 4962 4960 5016 4952 4952 5050 5035 4975 4975 5066 5022
##  [953] 4952 4962 4966 4996 5028 4896 4984 4924 5013 5014 4991 4929 5007 5012
##  [967] 5063 5097 5013 4946 4987 5016 5079 4991 4908 4962 5010 4972 4976 5008
##  [981] 5020 5070 5088 5053 4987 5010 4981 5061 5075 4994 4940 4984 5057 5012
##  [995] 4954 4986 5018 5032 5039 5041
```

(3B) What is the expected mean and variance of the vector in (3A). Show that the actual mean and variance are close to the expected mean and variance.

```
mean(myVals)
```

```
## [1] 4999.907
```

```
var(myVals)
```

```
## [1] 2277.081
```

```
exMean <- 10000*0.5
exMean
```

```
## [1] 5000
```

```
exVar <- 10000*0.5*0.5
exVar
```

```
## [1] 2500
```

(3C) Take the vector that results from (3A). For each element in that vector, calculate a p-value with binom.test(….)$p.value for the null hypothesis that the frequency of the allele in the population for that experiment is 1/2.

```
myPVals <- vector(length=length(myVals), mode = "double")

for(i in 1:length(myVals))
{
  myPVals[i] <- binom.test(myVals[i], 10000, alternative = "two.sided")$p.value
}

myPVals
```

```
##    [1] 0.275712392 0.502859752 0.880765579 0.322174200 0.596114133 0.515694243
##    [7] 0.528696656 0.928287806 0.211297407 0.013507339 0.087260803 0.373466715
##   [13] 0.667197766 0.053601407 0.787161859 0.465391922 0.711384474 0.384301368
##   [19] 0.541863922 0.087260803 0.111830241 0.741401814 0.568679874 0.177013015
##   [25] 0.681808033 0.787161859 0.756562732 0.555192799 0.610053665 0.652712597
##   [31] 0.284618728 0.638357198 0.960122720 0.880765579 0.555192799 0.312495210
##   [37] 0.502859752 0.652712597 0.818093181 0.771817931 0.771817931 0.083625142
##   [43] 0.053601407 0.211297407 0.865011219 0.756562732 0.928287806 0.190193191
##   [49] 0.771817931 0.865011219 0.555192799 0.582321567 0.067244582 0.992021354
##   [55] 0.091022954 0.912410093 0.126012497 0.726340619 0.250142599 0.865011219
##   [61] 0.046585528 0.568679874 0.802588859 0.992021354 0.944194122 0.849310327
##   [67] 0.652712597 0.250142599 0.726340619 0.046585528 0.976067252 0.787161859
##   [73] 0.502859752 0.441301443 0.726340619 0.218695137 0.312495210 0.044425799
##   [79] 0.284618728 0.056127786 0.064308167 0.441301443 0.696538585 0.818093181
##   [85] 0.865011219 0.266998102 0.912410093 0.912410093 0.849310327 0.126012497
##   [91] 0.787161859 0.912410093 0.667197766 0.944194122 0.912410093 0.880765579
##   [97] 0.610053665 0.880765579 0.034853127 0.258475126 0.258475126 0.441301443
##  [103] 0.681808033 0.406540001 0.681808033 0.352371627 0.944194122 0.465391922
##  [109] 0.226277098 0.362823198 0.395326180 0.490196082 0.711384474 0.384301368
##  [115] 0.234044771 0.849310327 0.258475126 0.342112645 0.741401814 0.083625142
##  [121] 0.164525599 0.992021354 0.515694243 0.091022954 0.741401814 0.234044771
##  [127] 0.152713445 0.226277098 0.056127786 0.046585528 0.250142599 0.928287806
##  [133] 0.638357198 0.726340619 0.624136095 0.568679874 0.756562732 0.042351172
##  [139] 0.022016621 0.912410093 0.652712597 0.976067252 0.103096740 0.275712392
##  [145] 0.865011219 0.258475126 0.044425799 0.711384474 0.477705956 0.880765579
##  [151] 0.726340619 0.928287806 0.944194122 0.094914438 0.126012497 0.696538585
##  [157] 0.944194122 0.912410093 0.266998102 0.170683777 0.197048180 0.741401814
##  [163] 0.756562732 0.477705956 0.865011219 0.303009761 0.711384474 0.568679874
##  [169] 0.596114133 0.008046008 0.002139043 0.802588859 0.515694243 0.490196082
##  [175] 0.098938092 0.441301443 0.726340619 0.250142599 0.312495210 0.003175792
##  [181] 0.976067252 0.596114133 0.031550081 0.528696656 0.833668979 0.131039314
##  [187] 0.944194122 0.896567269 0.395326180 0.515694243 0.865011219 0.322174200
##  [193] 0.528696656 0.502859752 0.992021354 0.031550081 0.429529214 0.441301443
##  [199] 0.912410093 0.241999522 0.741401814 0.726340619 1.000000000 0.880765579
##  [205] 0.944194122 0.741401814 0.802588859 0.787161859 0.303009761 0.992021354
##  [211] 0.652712597 0.190193191 0.040359092 0.667197766 0.960122720 0.322174200
##  [217] 0.944194122 0.226277098 0.756562732 0.107393193 0.555192799 0.064308167
##  [223] 0.610053665 0.384301368 0.197048180 0.638357198 0.865011219 0.667197766
##  [229] 0.741401814 0.638357198 0.912410093 0.880765579 0.322174200 0.490196082
##  [235] 0.429529214 0.258475126 0.944194122 0.912410093 0.568679874 0.541863922
##  [241] 0.190193191 0.912410093 0.258475126 0.756562732 0.711384474 0.771817931
##  [247] 0.362823198 0.865011219 0.528696656 0.960122720 0.373466715 0.667197766
##  [253] 0.681808033 0.726340619 0.992021354 0.042351172 0.453256352 0.756562732
##  [259] 0.211297407 0.912410093 0.928287806 0.802588859 0.726340619 0.515694243
##  [265] 0.204082320 0.896567269 0.098938092 0.234044771 0.241999522 0.696538585
##  [271] 0.833668979 0.322174200 0.429529214 0.515694243 0.541863922 0.250142599
##  [277] 0.865011219 0.880765579 0.528696656 0.515694243 0.303009761 0.502859752
##  [283] 0.352371627 0.147054804 0.555192799 0.624136095 0.170683777 0.352371627
##  [289] 0.170683777 0.528696656 0.322174200 0.928287806 0.928287806 0.992021354
##  [295] 0.087260803 0.094914438 0.218695137 0.638357198 0.064308167 0.880765579
##  [301] 0.944194122 0.865011219 0.638357198 0.880765579 0.076721900 0.384301368
##  [307] 0.865011219 0.896567269 0.944194122 0.515694243 0.126012497 0.741401814
##  [313] 0.787161859 0.880765579 0.417941510 0.756562732 0.802588859 0.502859752
```

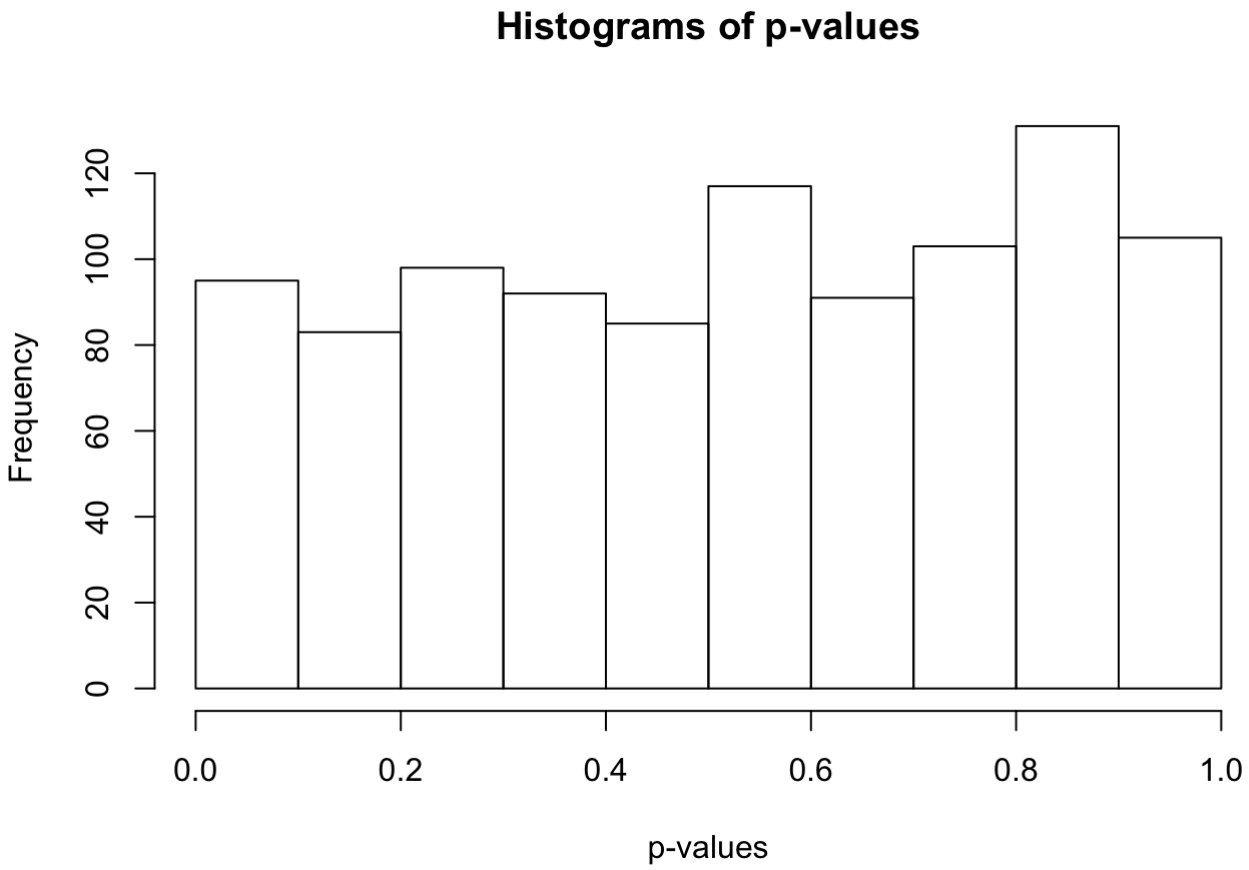
```
##  [319] 0.652712597 0.944194122 0.726340619 0.218695137 0.624136095 0.741401814
##  [325] 0.638357198 0.067244582 0.441301443 0.568679874 0.342112645 0.373466715
##  [331] 0.266998102 0.541863922 0.802588859 0.303009761 0.406540001 0.477705956
##  [337] 0.384301368 0.880765579 0.204082320 0.116410652 0.912410093 0.849310327
##  [343] 0.849310327 0.121137168 0.258475126 0.490196082 0.322174200 0.226277098
##  [349] 0.211297407 0.465391922 0.342112645 0.976067252 0.652712597 0.094914438
##  [355] 0.152713445 0.741401814 0.126012497 0.818093181 0.865011219 0.865011219
##  [361] 0.111830241 0.652712597 0.912410093 0.771817931 0.332046731 0.258475126
##  [367] 0.880765579 0.042351172 0.928287806 0.126012497 0.395326180 0.976067252
##  [373] 0.596114133 1.000000000 0.912410093 0.976067252 0.818093181 0.582321567
##  [379] 0.053601407 0.352371627 0.490196082 0.596114133 0.406540001 0.170683777
##  [385] 0.741401814 0.490196082 0.056127786 0.960122720 0.014281569 0.490196082
##  [391] 0.141557903 0.275712392 0.218695137 0.528696656 0.121137168 0.258475126
##  [397] 0.177013015 0.044425799 0.960122720 0.976067252 0.555192799 0.818093181
##  [403] 0.465391922 0.058752542 0.170683777 0.896567269 0.696538585 0.098938092
##  [409] 0.992021354 0.912410093 0.896567269 0.912410093 0.284618728 0.352371627
##  [415] 0.833668979 0.241999522 0.960122720 0.332046731 0.465391922 0.241999522
##  [421] 0.880765579 0.147054804 0.756562732 0.960122720 0.226277098 0.711384474
##  [427] 0.258475126 0.170683777 0.395326180 0.284618728 0.121137168 0.976067252
##  [433] 0.596114133 0.250142599 0.555192799 0.582321567 0.103096740 0.865011219
##  [439] 0.528696656 0.541863922 0.555192799 0.197048180 0.303009761 0.211297407
##  [445] 0.177013015 0.131039314 0.502859752 0.960122720 0.087260803 0.417941510
##  [451] 0.342112645 0.681808033 0.944194122 0.787161859 0.667197766 0.322174200
##  [457] 0.429529214 0.802588859 0.417941510 0.944194122 0.417941510 0.582321567
##  [463] 0.226277098 0.596114133 0.960122720 0.465391922 0.896567269 0.596114133
##  [469] 0.818093181 0.373466715 0.465391922 0.441301443 0.465391922 0.833668979
##  [475] 0.833668979 0.624136095 0.528696656 0.960122720 0.293717701 0.218695137
##  [481] 0.250142599 0.912410093 0.944194122 0.896567269 0.582321567 0.322174200
##  [487] 0.515694243 0.312495210 0.928287806 0.787161859 0.696538585 0.652712597
##  [493] 0.211297407 0.342112645 0.833668979 0.218695137 0.696538585 0.017783698
##  [499] 0.667197766 0.429529214 0.312495210 0.541863922 0.787161859 0.624136095
##  [505] 0.849310327 0.303009761 0.711384474 0.073448626 0.465391922 0.465391922
##  [511] 0.107393193 0.477705956 0.541863922 0.373466715 0.429529214 0.944194122
##  [517] 0.528696656 0.849310327 0.234044771 0.896567269 0.711384474 0.429529214
##  [523] 0.332046731 0.158536255 0.596114133 0.406540001 0.711384474 0.073448626
##  [529] 0.258475126 0.515694243 0.944194122 0.992021354 0.802588859 0.944194122
##  [535] 0.087260803 0.384301368 0.865011219 0.111830241 0.944194122 0.218695137
##  [541] 0.711384474 0.624136095 0.417941510 0.944194122 0.312495210 0.250142599
##  [547] 0.218695137 0.610053665 0.384301368 0.624136095 0.833668979 0.667197766
##  [553] 0.802588859 0.960122720 0.158536255 0.048832950 0.147054804 0.992021354
##  [559] 0.218695137 0.250142599 0.771817931 0.928287806 0.158536255 0.303009761
##  [565] 0.696538585 0.158536255 0.541863922 0.818093181 0.541863922 0.880765579
##  [571] 0.787161859 0.638357198 0.417941510 0.293717701 0.928287806 0.833668979
##  [577] 0.091022954 0.164525599 0.896567269 0.880765579 0.849310327 0.865011219
##  [583] 0.741401814 0.250142599 0.802588859 0.624136095 0.582321567 0.928287806
##  [589] 0.094914438 0.528696656 0.681808033 0.006725414 0.284618728 0.976067252
##  [595] 0.711384474 0.896567269 0.342112645 0.107393193 0.596114133 0.087260803
##  [601] 0.944194122 0.756562732 0.502859752 0.865011219 0.441301443 0.241999522
##  [607] 0.502859752 0.076721900 0.880765579 0.126012497 0.515694243 0.624136095
##  [613] 0.183515464 0.696538585 0.726340619 0.802588859 0.197048180 0.849310327
##  [619] 0.528696656 0.083625142 0.681808033 0.624136095 0.880765579 0.190193191
##  [625] 0.652712597 0.818093181 0.515694243 0.638357198 0.711384474 0.976067252
##  [631] 0.126012497 0.726340619 0.429529214 0.136220253 0.711384474 0.053601407
##  [637] 0.502859752 0.741401814 0.568679874 0.976067252 0.352371627 0.067244582
```

```
##  [643] 0.322174200 0.241999522 0.453256352 0.528696656 0.322174200 0.502859752
##  [649] 0.342112645 0.342112645 0.802588859 0.960122720 0.076721900 0.596114133
##  [655] 0.541863922 0.771817931 0.681808033 0.362823198 0.912410093 0.477705956
##  [661] 0.373466715 0.362823198 0.197048180 0.477705956 0.833668979 0.502859752
##  [667] 0.258475126 0.568679874 0.477705956 0.555192799 0.111830241 0.465391922
##  [673] 0.111830241 0.211297407 0.502859752 0.373466715 0.787161859 0.787161859
##  [679] 0.741401814 0.896567269 0.528696656 0.048832950 0.258475126 0.352371627
##  [685] 0.667197766 0.009050876 0.332046731 0.582321567 0.051170691 0.064308167
##  [691] 0.020883533 0.373466715 0.756562732 0.667197766 0.087260803 0.293717701
##  [697] 0.070290463 0.226277098 0.131039314 0.067244582 0.992021354 0.406540001
##  [703] 0.726340619 0.234044771 0.638357198 0.067244582 0.610053665 0.061478414
##  [709] 0.711384474 0.018768944 0.818093181 1.000000000 0.002787968 0.312495210
##  [715] 0.429529214 0.441301443 0.395326180 0.528696656 0.098938092 0.303009761
##  [721] 0.312495210 0.342112645 0.034853127 0.976067252 0.726340619 0.312495210
##  [727] 0.833668979 0.241999522 0.406540001 0.107393193 0.818093181 0.638357198
##  [733] 0.158536255 0.741401814 0.865011219 0.303009761 0.896567269 0.912410093
##  [739] 0.528696656 0.756562732 0.241999522 0.596114133 0.502859752 0.373466715
##  [745] 0.541863922 0.711384474 0.667197766 0.818093181 0.218695137 0.726340619
##  [751] 0.596114133 0.541863922 0.681808033 0.849310327 0.211297407 0.960122720
##  [757] 0.896567269 0.818093181 0.429529214 0.141557903 0.490196082 0.429529214
##  [763] 0.896567269 0.197048180 0.226277098 0.441301443 0.107393193 0.912410093
##  [769] 0.568679874 0.555192799 0.266998102 0.275712392 0.726340619 0.787161859
##  [775] 0.582321567 0.610053665 0.896567269 0.849310327 0.610053665 0.352371627
##  [781] 0.453256352 0.453256352 0.116410652 0.322174200 0.046585528 0.020883533
##  [787] 0.833668979 0.944194122 0.849310327 0.624136095 0.275712392 0.696538585
##  [793] 0.726340619 0.362823198 0.652712597 0.417941510 0.211297407 0.384301368
##  [799] 0.638357198 0.058752542 0.027100197 0.741401814 0.865011219 0.502859752
##  [805] 0.477705956 0.303009761 0.170683777 0.610053665 0.638357198 0.696538585
##  [811] 0.477705956 0.036612530 0.170683777 0.896567269 0.136220253 0.266998102
##  [817] 0.568679874 0.502859752 0.865011219 0.992021354 0.896567269 0.681808033
##  [823] 0.147054804 0.741401814 0.332046731 0.726340619 0.490196082 0.332046731
##  [829] 0.061478414 0.896567269 0.284618728 1.000000000 0.080113123 0.490196082
##  [835] 0.046585528 0.726340619 0.976067252 0.038447038 0.865011219 0.241999522
##  [841] 0.126012497 0.568679874 0.771817931 0.865011219 0.756562732 0.226277098
##  [847] 0.177013015 0.131039314 0.018768944 0.912410093 0.726340619 0.681808033
##  [853] 0.960122720 0.696538585 0.596114133 0.638357198 0.147054804 0.502859752
##  [859] 0.582321567 0.555192799 0.741401814 0.250142599 0.741401814 0.638357198
##  [865] 0.406540001 0.711384474 0.624136095 0.465391922 0.787161859 0.477705956
##  [871] 0.849310327 0.681808033 0.373466715 0.395326180 0.696538585 0.211297407
##  [877] 0.528696656 0.441301443 0.073448626 0.373466715 0.490196082 0.818093181
##  [883] 0.624136095 0.818093181 0.833668979 0.164525599 0.250142599 0.880765579
##  [889] 0.465391922 0.373466715 0.080113123 0.741401814 0.293717701 0.818093181
##  [895] 0.502859752 0.515694243 0.568679874 0.121137168 0.152713445 0.352371627
##  [901] 0.098938092 0.502859752 0.453256352 0.094914438 0.880765579 0.624136095
##  [907] 0.610053665 0.094914438 0.121137168 0.158536255 0.015094685 0.865011219
##  [913] 0.515694243 0.250142599 0.515694243 0.541863922 0.741401814 0.284618728
##  [919] 0.652712597 0.741401814 0.048832950 0.429529214 0.652712597 0.465391922
##  [925] 0.177013015 0.515694243 0.490196082 0.741401814 0.849310327 0.992021354
##  [931] 0.312495210 0.502859752 0.802588859 0.756562732 0.928287806 0.596114133
##  [937] 0.849310327 0.976067252 0.896567269 0.802588859 0.960122720 0.453256352
##  [943] 0.429529214 0.756562732 0.342112645 0.342112645 0.322174200 0.490196082
##  [949] 0.624136095 0.624136095 0.190193191 0.667197766 0.342112645 0.453256352
##  [955] 0.502859752 0.944194122 0.582321567 0.038447038 0.756562732 0.131039314
##  [961] 0.802588859 0.787161859 0.865011219 0.158536255 0.896567269 0.818093181
```

```
##  [967] 0.211297407 0.053601407 0.802588859 0.284618728 0.802588859 0.756562732
##  [973] 0.116410652 0.865011219 0.067244582 0.453256352 0.849310327 0.582321567
##  [979] 0.638357198 0.880765579 0.696538585 0.164525599 0.080113123 0.293717701
##  [985] 0.802588859 0.849310327 0.711384474 0.226277098 0.136220253 0.912410093
##  [991] 0.234044771 0.756562732 0.258475126 0.818093181 0.362823198 0.787161859
##  [997] 0.726340619 0.528696656 0.441301443 0.417941510
```

Graph the histogram of all of those p-values.
What distribution would you expect? Is that what you see?

```
hist(myPVals, xlab = "p-values", main = "Histograms of p-values")
```




```
#The resulting histrogram resembles a uniform distribution which is to be expected becua
se if the null hypothesis of the experiement is true than the resulting p-values will re
semble a uniform distribution
```

(3D) Change the expected value of 1/2 in (3C) to some other value. What happens to the p-values in the histogram. Would you expect the same shape of the p-value histogram with expected values of .49 as with .51? Why or why not?

```
myPValsD_0.49 <- vector(length=length(myVals), mode = "double")

for(i in 1:length(myVals))
{
  myPValsD_0.49[i] <- binom.test(myVals[i], 10000, p = 0.49, alternative = "two.sided")
$p.value
}

myPValsD_0.49
```

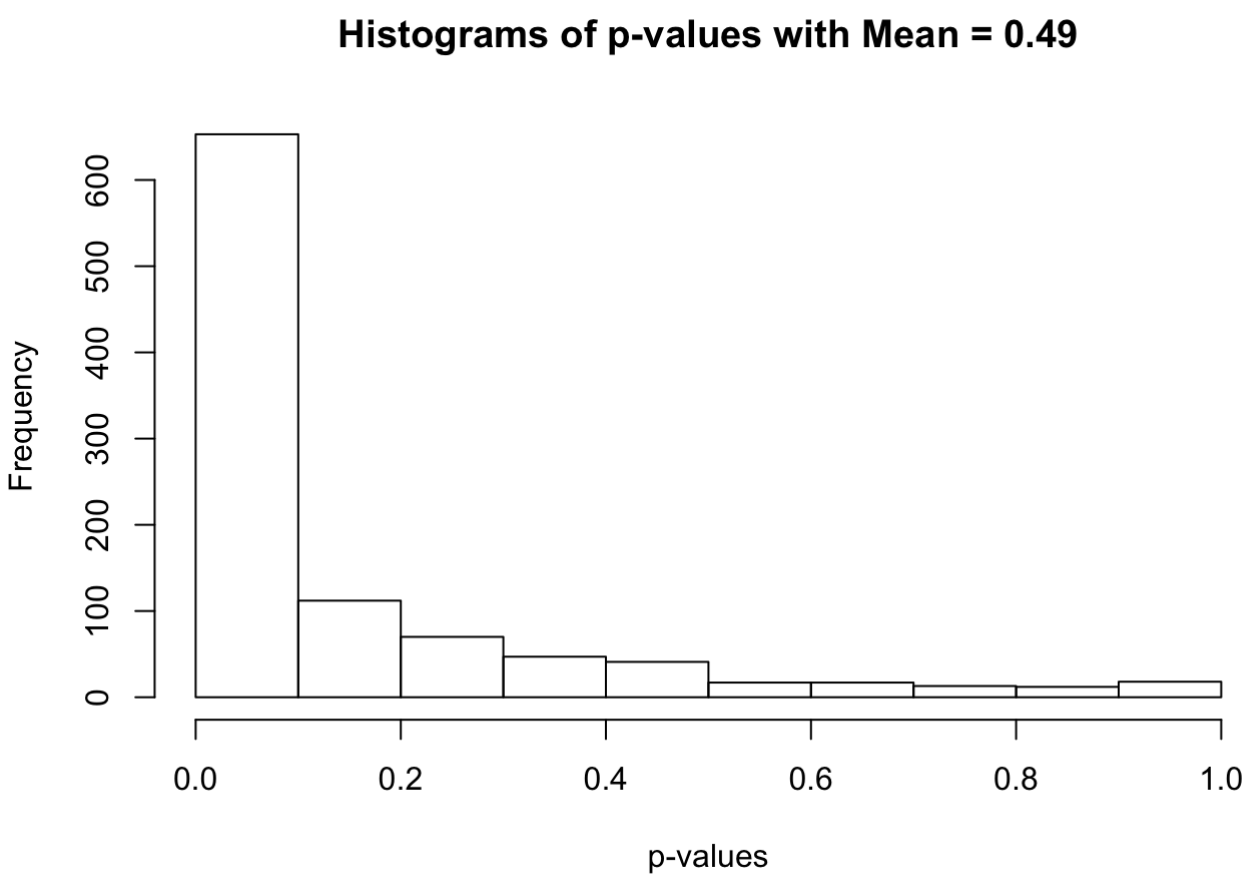
```
##    [1] 3.680485e-01 1.867658e-01 6.718985e-02 2.782512e-03 1.138611e-02
##    [6] 1.801767e-01 1.737620e-01 5.870198e-02 4.592336e-01 7.763667e-06
##   [11] 2.063308e-04 3.843172e-03 1.507445e-02 8.450228e-05 8.538043e-02
##   [16] 2.075985e-01 1.776090e-02 2.626406e-01 9.037068e-03 2.063308e-04
##   [21] 3.293186e-04 9.685941e-02 1.555419e-01 8.053324e-04 1.140479e-01
##   [26] 8.538043e-02 9.290328e-02 9.579724e-03 1.388099e-01 1.426214e-02
##   [31] 2.134648e-03 1.348869e-02 4.031908e-02 3.151607e-02 9.579724e-03
##   [36] 2.605566e-03 7.569989e-03 1.234996e-01 8.005272e-02 8.907789e-02
##   [41] 8.907789e-02 1.906098e-04 9.521488e-01 1.150366e-03 2.996889e-02
##   [46] 9.290328e-02 5.870198e-02 4.964411e-01 2.199008e-02 7.023432e-02
##   [51] 1.614468e-01 1.075293e-02 1.275187e-04 4.878779e-02 7.641441e-01
##   [56] 6.142648e-02 4.139242e-04 1.009491e-01 1.627880e-03 2.996889e-02
##   [61] 6.571385e-05 1.015125e-02 8.356332e-02 4.878779e-02 5.607860e-02
##   [66] 2.848745e-02 1.234996e-01 4.008382e-01 1.874525e-02 1.000000e+00
##   [71] 4.230990e-02 8.538043e-02 1.867658e-01 2.223931e-01 1.874525e-02
##   [76] 1.234011e-03 2.605566e-03 9.920198e-01 2.134648e-03 9.182073e-05
##   [81] 1.175341e-04 2.223931e-01 1.682215e-02 2.571294e-02 2.996889e-02
##   [86] 1.865516e-03 3.481678e-02 6.142648e-02 2.848745e-02 6.454682e-01
##   [91] 2.317528e-02 6.142648e-02 1.187000e-01 3.840827e-02 3.481678e-02
##   [96] 3.151607e-02 1.205217e-02 6.718985e-02 9.123926e-01 3.897182e-01
##  [101] 3.897182e-01 2.223931e-01 1.592723e-02 2.459761e-01 1.592723e-02
##  [106] 3.381215e-03 3.840827e-02 6.320130e-03 4.353228e-01 3.605470e-03
##  [111] 2.542133e-01 7.130697e-03 1.051753e-01 2.626406e-01 4.236419e-01
##  [116] 2.848745e-02 3.897182e-01 3.169730e-03 1.977698e-02 1.906098e-04
##  [121] 5.484477e-01 4.878779e-02 8.033389e-03 2.232636e-04 9.685941e-02
##  [126] 4.236419e-01 5.754236e-01 4.353228e-01 9.362281e-01 6.571385e-05
##  [131] 1.627880e-03 3.657498e-02 1.284493e-01 1.009491e-01 1.275254e-02
##  [136] 1.555419e-01 2.085796e-02 9.760625e-01 7.717735e-01 6.142648e-02
##  [141] 1.426214e-02 5.112421e-02 2.822220e-04 1.995923e-03 2.996889e-02
##  [146] 3.897182e-01 9.920198e-01 1.776090e-02 2.004748e-01 3.151607e-02
##  [151] 1.009491e-01 5.870198e-02 5.607860e-02 2.414944e-04 4.139242e-04
##  [156] 1.682215e-02 5.607860e-02 3.481678e-02 3.787880e-01 5.351979e-01
##  [161] 4.838628e-01 1.977698e-02 9.290328e-02 2.004748e-01 2.996889e-02
##  [166] 2.438964e-03 1.776090e-02 1.015125e-02 1.442259e-01 3.291663e-06
##  [171] 3.935442e-07 2.441555e-02 8.033389e-03 7.130697e-03 7.338195e-01
##  [176] 5.593451e-03 1.009491e-01 1.627880e-03 3.270130e-01 3.420161e-01
##  [181] 4.230990e-02 1.442259e-01 8.807419e-01 1.737620e-01 7.666292e-02
##  [186] 6.311777e-01 3.840827e-02 6.425483e-02 2.542133e-01 8.033389e-03
##  [191] 2.996889e-02 2.782512e-03 8.522026e-03 1.867658e-01 4.878779e-02
##  [196] 3.304616e-05 5.259160e-03 2.223931e-01 6.142648e-02 4.121465e-01
##  [201] 1.977698e-02 1.009491e-01 4.654169e-02 3.151607e-02 3.840827e-02
##  [206] 9.685941e-02 8.356332e-02 2.317528e-02 3.369824e-01 4.438325e-02
##  [211] 1.426214e-02 9.298422e-04 5.092748e-05 1.507445e-02 5.355358e-02
##  [216] 3.172373e-01 3.840827e-02 4.353228e-01 2.085796e-02 3.049200e-04
##  [221] 1.614468e-01 1.175341e-04 1.205217e-02 4.095027e-03 4.838628e-01
##  [226] 1.284493e-01 2.996889e-02 1.507445e-02 9.685941e-02 1.348869e-02
##  [231] 6.142648e-02 3.151607e-02 3.172373e-01 1.935312e-01 5.259160e-03
##  [236] 3.897182e-01 3.840827e-02 6.142648e-02 1.015125e-02 9.037068e-03
##  [241] 9.298422e-04 3.481678e-02 3.897182e-01 9.290328e-02 1.776090e-02
##  [246] 2.199008e-02 2.800688e-01 2.996889e-02 8.522026e-03 5.355358e-02
##  [251] 2.712588e-01 1.507445e-02 1.592723e-02 1.874525e-02 4.878779e-02
##  [256] 9.760625e-01 2.149041e-01 2.085796e-02 4.592336e-01 3.481678e-02
##  [261] 3.657498e-02 8.356332e-02 1.009491e-01 8.033389e-03 1.071989e-03
```

```
##  [266] 3.313126e-02 7.338195e-01 4.236419e-01 4.121465e-01 1.682215e-02
##  [271] 2.706953e-02 3.172373e-01 2.300672e-01 8.033389e-03 1.675194e-01
##  [276] 1.627880e-03 7.023432e-02 6.718985e-02 1.737620e-01 1.801767e-01
##  [281] 2.438964e-03 1.867658e-01 2.890711e-01 5.585063e-04 1.614468e-01
##  [286] 1.275254e-02 7.490538e-04 2.890711e-01 5.351979e-01 1.737620e-01
##  [291] 2.782512e-03 3.657498e-02 3.657498e-02 4.438325e-02 7.794465e-01
##  [296] 2.414944e-04 4.471873e-01 1.348869e-02 1.175341e-04 6.718985e-02
##  [301] 5.607860e-02 2.996889e-02 1.348869e-02 6.718985e-02 8.258465e-01
##  [306] 2.626406e-01 7.023432e-02 6.425483e-02 5.607860e-02 1.801767e-01
##  [311] 6.454682e-01 1.977698e-02 2.317528e-02 6.718985e-02 2.379278e-01
##  [316] 2.085796e-02 2.441555e-02 7.569989e-03 1.234996e-01 3.840827e-02
##  [321] 1.874525e-02 1.234011e-03 1.275254e-02 1.977698e-02 1.284493e-01
##  [326] 1.275187e-04 5.593451e-03 1.015125e-02 2.982665e-01 3.843172e-03
##  [331] 3.787880e-01 9.037068e-03 8.356332e-02 3.369824e-01 2.459761e-01
##  [336] 2.004748e-01 2.626406e-01 3.151607e-02 1.071989e-03 6.744410e-01
##  [341] 6.142648e-02 7.339107e-02 7.339107e-02 3.836928e-04 1.742978e-03
##  [346] 1.935312e-01 2.782512e-03 4.353228e-01 1.150366e-03 6.320130e-03
##  [351] 2.982665e-01 5.112421e-02 1.234996e-01 2.414944e-04 5.754236e-01
##  [356] 1.977698e-02 6.454682e-01 8.005272e-02 2.996889e-02 2.996889e-02
##  [361] 3.293186e-04 1.426214e-02 3.481678e-02 2.199008e-02 2.970369e-03
##  [366] 3.897182e-01 3.151607e-02 5.546510e-05 5.870198e-02 4.139242e-04
##  [371] 2.542133e-01 4.230990e-02 1.442259e-01 4.654169e-02 3.481678e-02
##  [376] 5.112421e-02 8.005272e-02 1.498024e-01 8.450228e-05 3.381215e-03
##  [381] 7.130697e-03 1.442259e-01 2.459761e-01 7.490538e-04 9.685941e-02
##  [386] 7.130697e-03 9.182073e-05 4.031908e-02 8.523842e-06 7.130697e-03
##  [391] 6.030107e-01 1.995923e-03 4.471873e-01 8.522026e-03 6.598908e-01
##  [396] 3.897182e-01 5.221115e-01 9.920198e-01 4.031908e-02 4.230990e-02
##  [401] 9.579724e-03 8.005272e-02 2.075985e-01 9.973495e-05 5.351979e-01
##  [406] 3.313126e-02 1.095406e-01 2.611147e-04 4.878779e-02 3.481678e-02
##  [411] 6.425483e-02 3.481678e-02 3.575006e-01 3.381215e-03 7.666292e-02
##  [416] 4.121465e-01 4.031908e-02 3.076551e-01 6.320130e-03 1.519815e-03
##  [421] 3.151607e-02 5.891427e-01 9.290328e-02 5.355358e-02 4.353228e-01
##  [426] 1.776090e-02 1.742978e-03 7.490538e-04 4.361770e-03 3.575006e-01
##  [431] 6.598908e-01 4.230990e-02 1.138611e-02 1.627880e-03 1.614468e-01
##  [436] 1.498024e-01 2.822220e-04 7.023432e-02 8.522026e-03 9.037068e-03
##  [441] 9.579724e-03 9.985765e-04 3.369824e-01 4.592336e-01 8.053324e-04
##  [446] 4.463687e-04 7.569989e-03 5.355358e-02 2.063308e-04 4.943021e-03
##  [451] 3.169730e-03 1.592723e-02 3.840827e-02 8.538043e-02 1.507445e-02
##  [456] 3.172373e-01 5.259160e-03 2.441555e-02 2.379278e-01 5.607860e-02
##  [461] 4.943021e-03 1.075293e-02 1.323241e-03 1.138611e-02 5.355358e-02
##  [466] 2.075985e-01 3.313126e-02 1.442259e-01 8.005272e-02 2.712588e-01
##  [471] 2.075985e-01 5.593451e-03 2.075985e-01 7.666292e-02 2.706953e-02
##  [476] 1.275254e-02 8.522026e-03 5.355358e-02 2.282164e-03 1.234011e-03
##  [481] 1.627880e-03 3.481678e-02 5.607860e-02 3.313126e-02 1.075293e-02
##  [486] 3.172373e-01 8.033389e-03 2.605566e-03 5.870198e-02 2.317528e-02
##  [491] 1.682215e-02 1.426214e-02 1.150366e-03 2.982665e-01 2.706953e-02
##  [496] 1.234011e-03 1.682215e-02 7.113293e-01 1.187000e-01 2.300672e-01
##  [501] 2.605566e-03 9.037068e-03 2.317528e-02 1.335519e-01 2.848745e-02
##  [506] 3.369824e-01 1.051753e-01 8.414581e-01 6.320130e-03 2.075985e-01
##  [511] 7.039046e-01 2.004748e-01 9.037068e-03 3.843172e-03 5.259160e-03
##  [516] 3.840827e-02 8.522026e-03 2.848745e-02 4.236419e-01 3.313126e-02
##  [521] 1.051753e-01 2.300672e-01 3.076551e-01 5.618574e-01 1.138611e-02
##  [526] 2.459761e-01 1.051753e-01 8.414581e-01 3.897182e-01 8.033389e-03
##  [531] 3.840827e-02 4.438325e-02 8.356332e-02 5.607860e-02 2.063308e-04
```

```
##  [536] 4.095027e-03 7.023432e-02 6.891138e-01 3.840827e-02 4.471873e-01
##  [541] 1.051753e-01 1.335519e-01 4.943021e-03 3.840827e-02 3.270130e-01
##  [546] 4.008382e-01 1.234011e-03 1.205217e-02 2.626406e-01 1.275254e-02
##  [551] 2.706953e-02 1.507445e-02 2.441555e-02 5.355358e-02 6.472886e-04
##  [556] 9.840411e-01 5.891427e-01 4.438325e-02 4.471873e-01 4.008382e-01
##  [561] 2.199008e-02 5.870198e-02 5.618574e-01 2.438964e-03 1.682215e-02
##  [566] 5.618574e-01 1.675194e-01 2.571294e-02 1.675194e-01 3.151607e-02
##  [571] 2.317528e-02 1.284493e-01 2.379278e-01 2.282164e-03 5.870198e-02
##  [576] 7.666292e-02 2.232636e-04 6.964458e-04 6.425483e-02 6.718985e-02
##  [581] 7.339107e-02 2.996889e-02 1.977698e-02 4.008382e-01 8.356332e-02
##  [586] 1.275254e-02 1.498024e-01 5.870198e-02 2.414944e-04 8.522026e-03
##  [591] 1.140479e-01 4.776179e-01 3.575006e-01 4.230990e-02 1.051753e-01
##  [596] 6.425483e-02 3.169730e-03 7.039046e-01 1.138611e-02 7.794465e-01
##  [601] 3.840827e-02 9.290328e-02 7.569989e-03 2.996889e-02 2.223931e-01
##  [606] 4.121465e-01 1.867658e-01 8.258465e-01 3.151607e-02 4.139242e-04
##  [611] 8.033389e-03 1.335519e-01 5.091916e-01 1.095406e-01 1.874525e-02
##  [616] 8.356332e-02 9.985765e-04 7.339107e-02 1.737620e-01 1.906098e-04
##  [621] 1.140479e-01 1.335519e-01 6.718985e-02 9.298422e-04 1.426214e-02
##  [626] 8.005272e-02 8.033389e-03 1.348869e-02 1.776090e-02 4.230990e-02
##  [631] 4.139242e-04 1.874525e-02 2.300672e-01 6.170238e-01 1.051753e-01
##  [636] 9.521488e-01 1.867658e-01 9.685941e-02 1.555419e-01 4.230990e-02
##  [641] 3.381215e-03 8.728629e-01 2.782512e-03 1.519815e-03 5.946796e-03
##  [646] 8.522026e-03 3.172373e-01 1.867658e-01 2.982665e-01 3.169730e-03
##  [651] 2.441555e-02 4.031908e-02 8.258465e-01 1.138611e-02 1.675194e-01
##  [656] 2.199008e-02 1.592723e-02 3.605470e-03 6.142648e-02 2.004748e-01
##  [661] 3.843172e-03 2.800688e-01 9.985765e-04 6.714427e-03 2.706953e-02
##  [666] 1.867658e-01 3.897182e-01 1.555419e-01 2.004748e-01 1.614468e-01
##  [671] 6.891138e-01 2.075985e-01 3.293186e-04 4.592336e-01 1.867658e-01
##  [676] 3.843172e-03 2.317528e-02 2.317528e-02 1.977698e-02 6.425483e-02
##  [681] 1.737620e-01 9.840411e-01 3.897182e-01 3.381215e-03 1.187000e-01
##  [686] 3.993925e-06 2.970369e-03 1.075293e-02 9.680885e-01 8.886441e-01
##  [691] 1.621565e-05 2.712588e-01 2.085796e-02 1.187000e-01 2.063308e-04
##  [696] 3.471450e-01 1.382989e-04 4.353228e-01 4.463687e-04 1.275187e-04
##  [701] 4.878779e-02 4.644168e-03 1.009491e-01 4.236419e-01 1.284493e-01
##  [706] 8.728629e-01 1.205217e-02 1.082900e-04 1.051753e-01 1.351979e-05
##  [711] 8.005272e-02 4.654169e-02 3.220774e-01 3.270130e-01 2.300672e-01
##  [716] 2.223931e-01 4.361770e-03 1.737620e-01 7.338195e-01 3.369824e-01
##  [721] 2.605566e-03 2.982665e-01 9.123926e-01 4.230990e-02 1.009491e-01
##  [726] 2.605566e-03 2.706953e-02 4.121465e-01 2.459761e-01 3.049200e-04
##  [731] 8.005272e-02 1.348869e-02 6.472886e-04 9.685941e-02 7.023432e-02
##  [736] 3.369824e-01 3.313126e-02 3.481678e-02 8.522026e-03 9.290328e-02
##  [741] 4.121465e-01 1.138611e-02 7.569989e-03 3.843172e-03 9.037068e-03
##  [746] 1.776090e-02 1.187000e-01 8.005272e-02 1.234011e-03 1.874525e-02
##  [751] 1.442259e-01 1.675194e-01 1.140479e-01 7.339107e-02 1.150366e-03
##  [756] 4.031908e-02 3.313126e-02 2.571294e-02 5.259160e-03 6.030107e-01
##  [761] 7.130697e-03 5.259160e-03 3.313126e-02 4.838628e-01 4.353228e-01
##  [766] 2.223931e-01 7.039046e-01 6.142648e-02 1.015125e-02 1.614468e-01
##  [771] 1.865516e-03 3.680485e-01 1.009491e-01 8.538043e-02 1.075293e-02
##  [776] 1.388099e-01 3.313126e-02 7.339107e-02 1.205217e-02 3.381215e-03
##  [781] 2.149041e-01 2.149041e-01 6.744410e-01 3.172373e-01 1.000000e+00
##  [786] 7.565156e-01 2.706953e-02 5.607860e-02 2.848745e-02 1.335519e-01
##  [791] 3.680485e-01 1.682215e-02 1.874525e-02 3.605470e-03 1.426214e-02
##  [796] 2.379278e-01 1.150366e-03 4.095027e-03 1.284493e-01 9.203329e-01
##  [801] 8.336362e-01 1.977698e-02 2.996889e-02 7.569989e-03 6.714427e-03
```

```
##  [806] 3.369824e-01 7.490538e-04 1.388099e-01 1.348869e-02 1.682215e-02
##  [811] 6.714427e-03 4.288629e-05 7.490538e-04 3.313126e-02 6.170238e-01
##  [816] 3.787880e-01 1.015125e-02 1.867658e-01 7.023432e-02 4.438325e-02
##  [821] 6.425483e-02 1.592723e-02 5.891427e-01 1.977698e-02 2.970369e-03
##  [826] 1.009491e-01 1.935312e-01 3.076551e-01 1.082900e-04 6.425483e-02
##  [831] 3.575006e-01 4.654169e-02 1.760197e-04 1.935312e-01 1.000000e+00
##  [836] 1.874525e-02 4.230990e-02 4.674320e-05 2.996889e-02 4.121465e-01
##  [841] 6.454682e-01 1.015125e-02 2.199008e-02 7.023432e-02 9.290328e-02
##  [846] 4.353228e-01 8.053324e-04 4.463687e-04 1.351979e-05 3.481678e-02
##  [851] 1.874525e-02 1.140479e-01 5.355358e-02 1.095406e-01 1.138611e-02
##  [856] 1.348869e-02 5.585063e-04 7.569989e-03 1.075293e-02 1.614468e-01
##  [861] 9.685941e-02 4.008382e-01 9.685941e-02 1.348869e-02 2.459761e-01
##  [866] 1.776090e-02 1.335519e-01 2.075985e-01 8.538043e-02 2.004748e-01
##  [871] 2.848745e-02 1.592723e-02 3.843172e-03 4.361770e-03 1.682215e-02
##  [876] 4.592336e-01 8.522026e-03 5.593451e-03 8.414581e-01 3.843172e-03
##  [881] 7.130697e-03 8.005272e-02 1.275254e-02 8.005272e-02 2.706953e-02
##  [886] 6.964458e-04 1.627880e-03 6.718985e-02 6.320130e-03 3.843172e-03
##  [891] 1.760197e-04 1.977698e-02 3.471450e-01 8.005272e-02 1.867658e-01
##  [896] 8.033389e-03 1.555419e-01 6.598908e-01 6.013744e-04 3.381215e-03
##  [901] 7.338195e-01 7.569989e-03 5.946796e-03 2.414944e-04 6.718985e-02
##  [906] 1.275254e-02 1.388099e-01 2.414944e-04 3.836928e-04 5.618574e-01
##  [911] 9.354845e-06 2.996889e-02 8.033389e-03 4.008382e-01 8.033389e-03
##  [916] 9.037068e-03 9.685941e-02 3.575006e-01 1.234996e-01 1.977698e-02
##  [921] 7.148692e-05 2.300672e-01 1.426214e-02 2.075985e-01 5.221115e-01
##  [926] 8.033389e-03 1.935312e-01 1.977698e-02 7.339107e-02 4.438325e-02
##  [931] 2.605566e-03 1.867658e-01 2.441555e-02 9.290328e-02 5.870198e-02
##  [936] 1.442259e-01 2.848745e-02 5.112421e-02 6.425483e-02 8.356332e-02
##  [941] 4.031908e-02 2.149041e-01 2.300672e-01 2.085796e-02 2.982665e-01
##  [946] 2.982665e-01 2.782512e-03 7.130697e-03 1.335519e-01 1.335519e-01
##  [951] 9.298422e-04 1.507445e-02 2.982665e-01 2.149041e-01 1.867658e-01
##  [956] 5.607860e-02 1.075293e-02 9.441830e-01 9.290328e-02 6.311777e-01
##  [961] 2.441555e-02 2.317528e-02 7.023432e-02 5.618574e-01 3.313126e-02
##  [966] 2.571294e-02 1.150366e-03 8.450228e-05 2.441555e-02 3.575006e-01
##  [971] 8.356332e-02 2.085796e-02 3.555348e-04 7.023432e-02 8.728629e-01
##  [976] 2.149041e-01 2.848745e-02 1.498024e-01 1.284493e-01 3.151607e-02
##  [981] 1.682215e-02 6.964458e-04 1.760197e-04 2.282164e-03 8.356332e-02
##  [986] 2.848745e-02 1.051753e-01 1.323241e-03 4.811745e-04 6.142648e-02
##  [991] 4.236419e-01 9.290328e-02 1.742978e-03 2.571294e-02 2.800688e-01
##  [996] 8.538043e-02 1.874525e-02 8.522026e-03 5.593451e-03 4.943021e-03
```

```
hist(myPValsD_0.49, xlab = "p-values", main = "Histograms of p-values with Mean = 0.49")
```




```
#We don't see a uniform distribution becuase the null hypothesis is not true, because we generated the data under a different expected value, therefor the resulting p-value are  mainly small (same for 0.51)
```

```
myPValsD_0.51 <- vector(length=length(myVals), mode = "double")

for(i in 1:length(myVals))
{
  myPValsD_0.51[i] <- binom.test(myVals[i], 10000, p = 0.51, alternative = "two.sided")
$p.value
}

myPValsD_0.51
```

```
##    [1] 1.995923e-03 7.569989e-03 3.151607e-02 3.172373e-01 1.442259e-01
##    [6] 8.033389e-03 8.522026e-03 3.657498e-02 1.150366e-03 6.382900e-01
##   [11] 7.794465e-01 2.712588e-01 1.187000e-01 9.521488e-01 2.317528e-02
##   [16] 6.320130e-03 1.051753e-01 4.095027e-03 1.675194e-01 7.794465e-01
##   [21] 6.891138e-01 1.977698e-02 1.015125e-02 5.221115e-01 1.592723e-02
##   [26] 2.317528e-02 2.085796e-02 1.614468e-01 1.205217e-02 1.234996e-01
##   [31] 3.575006e-01 1.284493e-01 5.355358e-02 6.718985e-02 1.614468e-01
##   [36] 3.270130e-01 1.867658e-01 1.426214e-02 2.571294e-02 2.199008e-02
##   [41] 2.199008e-02 7.948349e-01 8.450228e-05 4.592336e-01 7.023432e-02
##   [46] 2.085796e-02 3.657498e-02 9.298422e-04 8.907789e-02 2.996889e-02
##   [51] 9.579724e-03 1.498024e-01 8.728629e-01 4.438325e-02 2.232636e-04
##   [56] 3.481678e-02 6.454682e-01 1.874525e-02 4.008382e-01 7.023432e-02
##   [61] 1.000000e+00 1.555419e-01 2.441555e-02 4.438325e-02 3.840827e-02
##   [66] 7.339107e-02 1.426214e-02 1.627880e-03 1.009491e-01 6.571385e-05
##   [71] 5.112421e-02 2.317528e-02 7.569989e-03 5.593451e-03 1.009491e-01
##   [76] 4.471873e-01 3.270130e-01 6.038393e-05 3.575006e-01 9.362281e-01
##   [81] 8.886441e-01 5.593451e-03 1.095406e-01 8.005272e-02 7.023432e-02
##   [86] 3.787880e-01 6.142648e-02 3.481678e-02 7.339107e-02 4.139242e-04
##   [91] 8.538043e-02 3.481678e-02 1.507445e-02 5.607860e-02 6.142648e-02
##   [96] 6.718985e-02 1.388099e-01 3.151607e-02 3.933257e-05 1.742978e-03
##  [101] 1.742978e-03 5.593451e-03 1.140479e-01 4.644168e-03 1.140479e-01
##  [106] 2.890711e-01 5.607860e-02 2.075985e-01 1.323241e-03 2.800688e-01
##  [111] 4.361770e-03 1.935312e-01 1.776090e-02 4.095027e-03 1.418391e-03
##  [116] 7.339107e-02 1.742978e-03 2.982665e-01 9.685941e-02 7.948349e-01
##  [121] 6.964458e-04 4.438325e-02 1.801767e-01 7.641441e-01 1.977698e-02
##  [126] 1.418391e-03 6.013744e-04 1.323241e-03 9.182073e-05 1.000000e+00
##  [131] 4.008382e-01 5.870198e-02 1.348869e-02 1.874525e-02 1.335519e-01
##  [136] 1.015125e-02 9.290328e-02 5.546510e-05 1.774868e-05 3.481678e-02
##  [141] 1.234996e-01 4.230990e-02 7.188082e-01 3.680485e-01 7.023432e-02
##  [146] 1.742978e-03 6.038393e-05 1.051753e-01 6.714427e-03 6.718985e-02
##  [151] 1.874525e-02 3.657498e-02 3.840827e-02 7.489333e-01 6.454682e-01
##  [156] 1.095406e-01 3.840827e-02 6.142648e-02 1.865516e-03 7.490538e-04
##  [161] 9.985765e-04 9.685941e-02 2.085796e-02 6.714427e-03 7.023432e-02
##  [166] 3.369824e-01 1.051753e-01 1.555419e-01 1.138611e-02 5.156102e-01
##  [171] 2.845224e-01 8.356332e-02 1.801767e-01 1.935312e-01 2.611147e-04
##  [176] 2.223931e-01 1.874525e-02 4.008382e-01 2.605566e-03 7.347104e-07
##  [181] 5.112421e-02 1.138611e-02 3.304616e-05 8.522026e-03 2.706953e-02
##  [186] 4.463687e-04 5.607860e-02 3.313126e-02 4.361770e-03 1.801767e-01
##  [191] 7.023432e-02 3.172373e-01 1.737620e-01 7.569989e-03 4.438325e-02
##  [196] 8.807419e-01 2.300672e-01 5.593451e-03 3.481678e-02 1.519815e-03
##  [201] 9.685941e-02 1.874525e-02 4.654169e-02 6.718985e-02 5.607860e-02
##  [206] 1.977698e-02 2.441555e-02 8.538043e-02 2.438964e-03 4.878779e-02
##  [211] 1.234996e-01 4.964411e-01 9.601147e-01 1.187000e-01 4.031908e-02
##  [216] 2.782512e-03 5.607860e-02 1.323241e-03 9.290328e-02 7.039046e-01
##  [221] 9.579724e-03 8.886441e-01 1.388099e-01 2.626406e-01 9.985765e-04
##  [226] 1.348869e-02 7.023432e-02 1.187000e-01 1.977698e-02 1.284493e-01
##  [231] 3.481678e-02 6.718985e-02 2.782512e-03 7.130697e-03 2.300672e-01
##  [236] 1.742978e-03 5.607860e-02 3.481678e-02 1.555419e-01 1.675194e-01
##  [241] 4.964411e-01 6.142648e-02 1.742978e-03 2.085796e-02 1.051753e-01
##  [246] 8.907789e-02 3.605470e-03 7.023432e-02 1.737620e-01 4.031908e-02
##  [251] 3.843172e-03 1.187000e-01 1.140479e-01 1.009491e-01 4.438325e-02
##  [256] 5.546510e-05 5.946796e-03 9.290328e-02 1.150366e-03 6.142648e-02
##  [261] 5.870198e-02 2.441555e-02 1.874525e-02 1.801767e-01 4.714595e-01
```

```
##  [266] 6.425483e-02 2.611147e-04 1.418391e-03 1.519815e-03 1.095406e-01
##  [271] 7.666292e-02 2.782512e-03 5.259160e-03 1.801767e-01 9.037068e-03
##  [276] 4.008382e-01 2.996889e-02 3.151607e-02 8.522026e-03 8.033389e-03
##  [281] 3.369824e-01 7.569989e-03 3.381215e-03 5.891427e-01 9.579724e-03
##  [286] 1.335519e-01 5.351979e-01 3.381215e-03 7.490538e-04 8.522026e-03
##  [291] 3.172373e-01 5.870198e-02 5.870198e-02 4.878779e-02 2.063308e-04
##  [296] 7.489333e-01 1.234011e-03 1.284493e-01 8.886441e-01 3.151607e-02
##  [301] 3.840827e-02 7.023432e-02 1.284493e-01 3.151607e-02 1.624846e-04
##  [306] 4.095027e-03 2.996889e-02 3.313126e-02 3.840827e-02 8.033389e-03
##  [311] 4.139242e-04 9.685941e-02 8.538043e-02 3.151607e-02 4.943021e-03
##  [316] 9.290328e-02 8.356332e-02 1.867658e-01 1.426214e-02 5.607860e-02
##  [321] 1.009491e-01 4.471873e-01 1.335519e-01 9.685941e-02 1.348869e-02
##  [326] 8.728629e-01 2.223931e-01 1.555419e-01 3.169730e-03 2.712588e-01
##  [331] 1.865516e-03 1.675194e-01 2.441555e-02 2.438964e-03 4.644168e-03
##  [336] 6.714427e-03 4.095027e-03 6.718985e-02 4.714595e-01 3.555348e-04
##  [341] 3.481678e-02 2.848745e-02 2.848745e-02 6.598908e-01 3.897182e-01
##  [346] 7.130697e-03 3.172373e-01 1.323241e-03 4.592336e-01 2.075985e-01
##  [351] 3.169730e-03 4.230990e-02 1.426214e-02 7.489333e-01 6.013744e-04
##  [356] 9.685941e-02 4.139242e-04 2.571294e-02 7.023432e-02 7.023432e-02
##  [361] 6.891138e-01 1.234996e-01 6.142648e-02 8.907789e-02 3.076551e-01
##  [366] 1.742978e-03 6.718985e-02 9.760625e-01 3.657498e-02 6.454682e-01
##  [371] 4.361770e-03 5.112421e-02 1.138611e-02 4.654169e-02 6.142648e-02
##  [376] 4.230990e-02 2.571294e-02 1.075293e-02 9.521488e-01 2.890711e-01
##  [381] 1.935312e-01 1.138611e-02 4.644168e-03 5.351979e-01 1.977698e-02
##  [386] 1.935312e-01 9.362281e-01 5.355358e-02 6.526477e-01 1.935312e-01
##  [391] 5.184983e-04 3.680485e-01 1.234011e-03 1.737620e-01 3.836928e-04
##  [396] 1.742978e-03 8.053324e-04 6.038393e-05 5.355358e-02 5.112421e-02
##  [401] 1.614468e-01 2.571294e-02 6.320130e-03 9.203329e-01 7.490538e-04
##  [406] 6.425483e-02 1.682215e-02 7.338195e-01 4.438325e-02 6.142648e-02
##  [411] 3.313126e-02 6.142648e-02 2.134648e-03 2.890711e-01 2.706953e-02
##  [416] 1.519815e-03 5.355358e-02 2.970369e-03 2.075985e-01 4.121465e-01
##  [421] 6.718985e-02 5.585063e-04 2.085796e-02 4.031908e-02 1.323241e-03
##  [426] 1.051753e-01 3.897182e-01 5.351979e-01 2.542133e-01 2.134648e-03
##  [431] 3.836928e-04 5.112421e-02 1.442259e-01 4.008382e-01 9.579724e-03
##  [436] 1.075293e-02 7.188082e-01 2.996889e-02 1.737620e-01 1.675194e-01
##  [441] 1.614468e-01 4.838628e-01 2.438964e-03 1.150366e-03 5.221115e-01
##  [446] 6.311777e-01 1.867658e-01 4.031908e-02 7.794465e-01 2.379278e-01
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##  [471] 6.320130e-03 2.223931e-01 6.320130e-03 2.706953e-02 7.666292e-02
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##  [486] 2.782512e-03 1.801767e-01 3.270130e-01 3.657498e-02 8.538043e-02
##  [491] 1.095406e-01 1.234996e-01 4.592336e-01 3.169730e-03 7.666292e-02
##  [496] 4.471873e-01 1.095406e-01 1.233778e-05 1.507445e-02 5.259160e-03
##  [501] 3.270130e-01 1.675194e-01 8.538043e-02 1.275254e-02 7.339107e-02
##  [506] 2.438964e-03 1.776090e-02 1.499333e-04 2.075985e-01 6.320130e-03
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##  [521] 1.776090e-02 5.259160e-03 2.970369e-03 6.472886e-04 1.442259e-01
##  [526] 4.644168e-03 1.776090e-02 1.499333e-04 1.742978e-03 1.801767e-01
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##  [546] 1.627880e-03 4.471873e-01 1.388099e-01 4.095027e-03 1.335519e-01
##  [551] 7.666292e-02 1.187000e-01 8.356332e-02 4.031908e-02 5.618574e-01
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##  [566] 6.472886e-04 9.037068e-03 8.005272e-02 9.037068e-03 6.718985e-02
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##  [586] 1.335519e-01 1.075293e-02 3.657498e-02 7.489333e-01 1.737620e-01
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##  [611] 1.801767e-01 1.275254e-02 8.655136e-04 1.682215e-02 1.009491e-01
##  [616] 2.441555e-02 4.838628e-01 2.848745e-02 8.522026e-03 7.948349e-01
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##  [626] 2.571294e-02 1.801767e-01 1.284493e-01 1.051753e-01 5.112421e-02
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##  [666] 7.569989e-03 1.742978e-03 1.015125e-02 6.714427e-03 9.579724e-03
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##  [696] 2.282164e-03 8.571322e-01 1.323241e-03 6.311777e-01 8.728629e-01
##  [701] 4.438325e-02 2.459761e-01 1.874525e-02 1.418391e-03 1.348869e-02
##  [706] 1.275187e-04 1.388099e-01 9.044695e-01 1.776090e-02 7.262881e-01
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##  [721] 3.270130e-01 3.169730e-03 3.933257e-05 5.112421e-02 1.874525e-02
##  [726] 3.270130e-01 7.666292e-02 1.519815e-03 4.644168e-03 7.039046e-01
##  [731] 2.571294e-02 1.284493e-01 5.618574e-01 1.977698e-02 2.996889e-02
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##  [741] 1.519815e-03 1.442259e-01 1.867658e-01 2.712588e-01 1.675194e-01
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##  [751] 1.138611e-02 9.037068e-03 1.592723e-02 2.848745e-02 4.592336e-01
##  [756] 5.355358e-02 6.425483e-02 8.005272e-02 2.300672e-01 5.184983e-04
##  [761] 1.935312e-01 2.300672e-01 6.425483e-02 9.985765e-04 1.323241e-03
##  [766] 5.593451e-03 3.049200e-04 3.481678e-02 1.555419e-01 9.579724e-03
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##  [791] 1.995923e-03 1.095406e-01 1.009491e-01 2.800688e-01 1.234996e-01
##  [796] 4.943021e-03 4.592336e-01 2.626406e-01 1.348869e-02 9.973495e-05
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##  [846] 1.323241e-03 5.221115e-01 6.311777e-01 7.262881e-01 6.142648e-02
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##  [901] 2.611147e-04 1.867658e-01 2.149041e-01 7.489333e-01 3.151607e-02
##  [906] 1.335519e-01 1.205217e-02 7.489333e-01 6.598908e-01 6.472886e-04
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##  [926] 1.801767e-01 7.130697e-03 9.685941e-02 2.848745e-02 4.878779e-02
##  [931] 3.270130e-01 7.569989e-03 8.356332e-02 2.085796e-02 3.657498e-02
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##  [986] 7.339107e-02 1.776090e-02 4.353228e-01 6.170238e-01 3.481678e-02
##  [991] 1.418391e-03 2.085796e-02 3.897182e-01 8.005272e-02 3.605470e-03
##  [996] 2.317528e-02 1.009491e-01 1.737620e-01 2.223931e-01 2.379278e-01
```
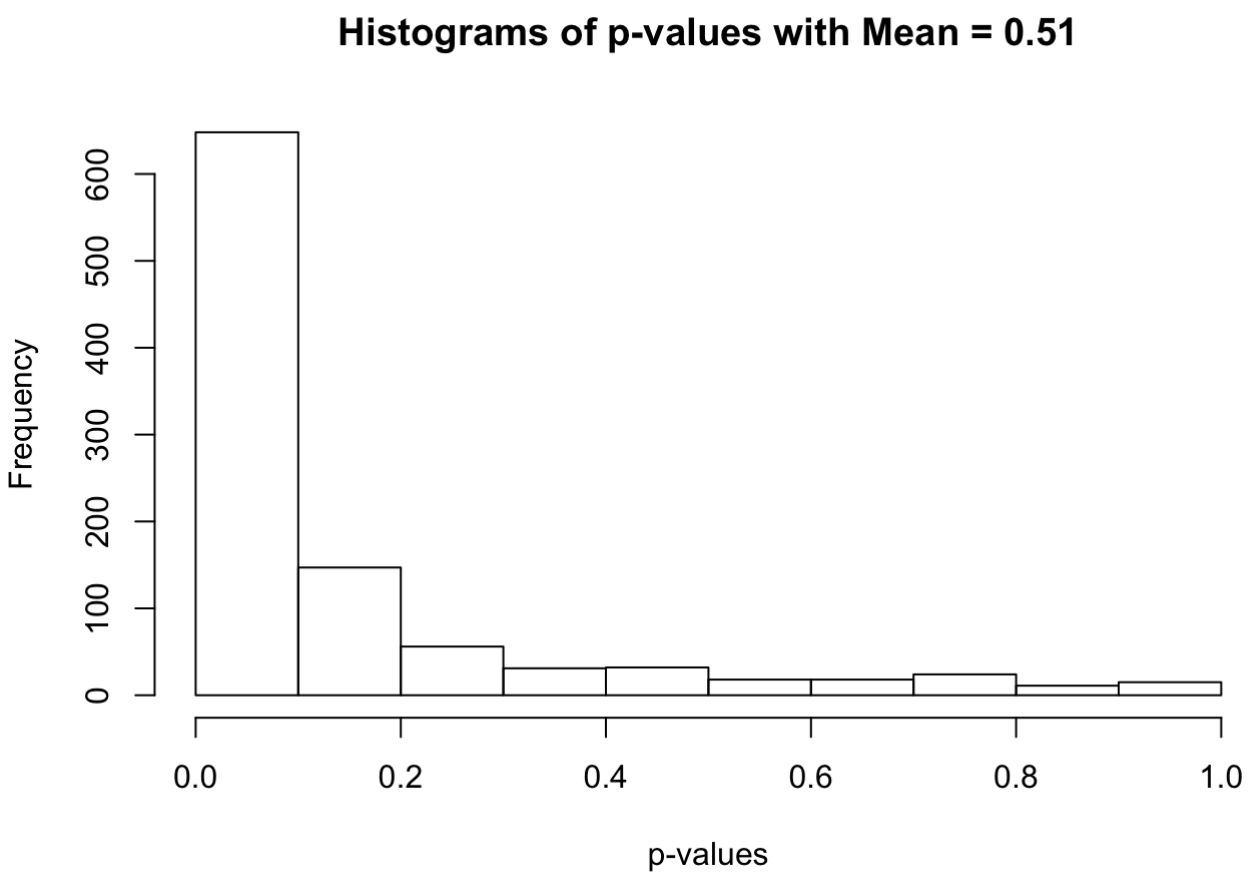

```
hist(myPValsD_0.51, xlab = "p-values", main = "Histograms of p-values with Mean = 0.51")
```




```
#same as above in 0.49 expected value
```