

09. Seja X_1, X_2, \dots, X_n uma amostra aleatória da variável aleatória $X \sim \text{Exp}(\theta)$, $\theta > 0$.

(i) Encontre o teste da razão de verossimilhança generalizada, **TRVG** para testar:

$$H_0 : \theta = 1 \quad \text{vs} \quad H_1 : \theta \neq 1.$$

(ii) Se você observar $n = 5$,

$$x_1 = 0,8 ; x_2 = 1,3 ; x_3 = 1,8 ; x_4 = 0,9 \quad \text{e} \quad x_5 = 1,0,$$

qual a sua decisão ao nível de $\alpha = 0,05$?

Solução:

$$X \sim \text{Exp}(\theta)$$

sua f.d.p. é dada por:

$$f(x|\theta) = \theta e^{-\theta x} I_A(x), A = (0, \infty).$$

A função de verossimilhança é dada por:

$$L(\theta) = \prod_{i=1}^n f(x_i|\theta) = \prod_{i=1}^n \theta e^{-\theta x_i} = \theta^n e^{-\theta s},$$

$$s = \sum_{i=1}^n x_i.$$

Sejam

$$\Theta = (0, \infty).$$

$$\Theta_0 = \{1\} \quad \Theta_1 = (0, \infty) - \{1\}.$$

O supremo de $L(\theta)$ em Θ_0 é dado por:

$$Num = L(1) = 1^n e^{-1s} = e^{-s} = e^{-n\bar{X}}$$

O estimador de MV de θ é dado por:

$$\hat{\theta} = \frac{1}{\bar{X}}.$$

O supremo de $L(\theta)$ em Θ é dado por:

$$Den = L(\bar{X}^{-1}) = (\bar{X}^{-1})^n e^{-\bar{X}^{-1} s},$$

$$Den = L(\bar{X}^{-1}) = \bar{X}^{-n} e^{-n}.$$

$$\lambda = \frac{Num}{Den} = \frac{e^{-n\bar{X}}}{\bar{X}^{-n} e^{-n}} = \bar{X}^n e^{-n(\bar{X}-1)}..$$

$$V = -2\log(\lambda) = -2(-n\log(\bar{X}) - n(\bar{X} - 1))$$

$$V = 2n(\log(\bar{X}) + \bar{X} - 1).$$

```
> amostra= c(0.8,1.3,1.8,0.9,1)
> n=length(amostra);n
[1] 5
>
> SX=sum(amostra);SX
[1] 5.8
> xb=SX/n;xb
[1] 1.16
>
> a=log(xb);a
[1] 0.14842
>
> v_cal=-2*n*(a-xb +1);v_cal
[1] 0.1157999
>
> alfa=0.05
> v_tab=qchisq(1-alfa,1);v_tab
[1] 3.841459
>
> v_cal < v_tab
[1] TRUE
>
>
> ###Conclusão: Não rejeitar H_0
>
>
>
> nd=pchisq(v_cal,1,lower.tail=F);nd
[1] 0.7336352
>
> nd > alfa
[1] TRUE
>
> ###Conclusão: Não rejeitar H_0
>
>
>
```

Vamos criar uma função no **R** para ilustrar a aproximação para a qui-quadrado(1):

Vamos gerar $N = 1000$ amostras de tamanho $n = 5$ de $X \sim Exp(1)$.

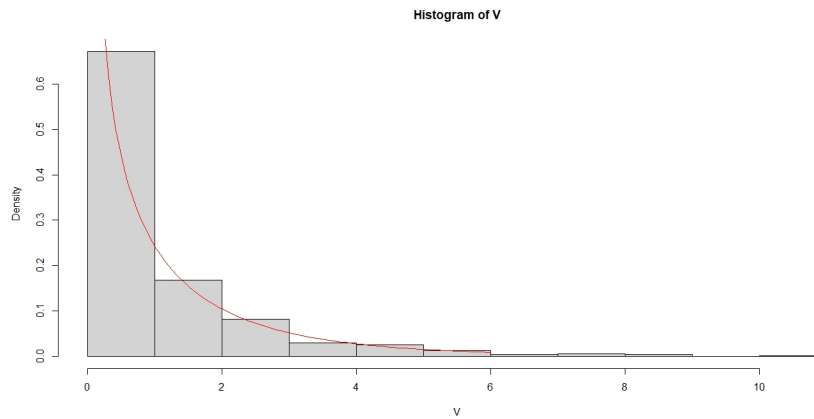


Figura 1:

Para cada amostra vamos calcular o valor:

$$v = -2 * n(\log(\bar{x}) - \bar{x} + 1).$$

Estes valores geraram o seguinte histograma. Colocamos a densidade da $Exp(1)$ em vermelho. Analisem a qualidade do ajuste.

```
>
>
> ####Vamos gerar N= 1000 amostras de tamanho n=5 de X ~exp(1)
>
>
>
>
> set.seed(32)
>
>
> A=rexp( 5*1000,1)
>
> mean(A);var(A)
[1] 1.009608
[1] 0.9821454
>
> A=matrix(A,nrow=5);A
[,1]      [,2]      [,3]      [,4]      [,5]      [,6]      [,7]
[1,] 0.01168105 0.5223125 0.2241500 1.3710387 0.2234412 0.03969090 0.6524386
[2,] 0.18961677 0.3468835 0.5452723 0.2444116 1.2701960 1.57322829 1.8305159
[3,] 0.61749427 1.2416494 0.7579960 0.4732094 0.6492189 0.59556845 0.5408978
[4,] 0.45763945 0.3160050 0.4976043 0.7893251 0.3062250 0.09636094 2.0842860
[5,] 1.60219489 0.9786256 0.5988987 0.3205904 0.5365231 0.07048542 0.6221700
[,8]      [,9]      [,10]      [,11]      [,12]      [,13]      [,14]
[1,] 0.2419074 0.5880262 0.07683987 1.21209702 4.18806027 1.3872914 0.29233492
[2,] 3.7564204 1.4471376 0.67490740 1.21704772 1.80119247 1.0092505 0.02101077
[3,] 6.9098203 0.4448014 0.70959456 0.06389265 0.06472943 0.7703104 0.96620124
[4,] 0.6739824 1.9342374 0.71296898 0.07945744 0.82530795 2.8460194 0.58322858
[5,] 0.4727681 2.0534608 1.46643889 0.06582646 0.03784564 2.5281769 0.73697879
```

	[,15]	[,16]	[,17]	[,18]	[,19]	[,20]	[,21]
[1,]	0.4536035	1.62130363	1.1842474	1.7331863	3.2056616	5.9833245	0.42510306
[2,]	1.4779251	0.01302827	0.1001950	0.2048191	0.2748205	0.8232613	3.88442537
[3,]	1.6738528	1.22390940	2.4938533	0.3048839	0.2097150	1.0608923	0.09921258
[4,]	1.2555274	2.02848067	1.7946117	0.7712574	1.9071781	3.9506870	0.09823450
[5,]	1.5765294	0.17165777	0.1001849	1.4367326	2.1753317	2.1602844	2.33031250
	[,22]	[,23]	[,24]	[,25]	[,26]	[,27]	[,28]
[1,]	0.1332140	0.9383361	0.9067784	1.372409631	2.3640600	0.06072732	0.14680748
[2,]	1.1105959	0.4469469	1.5088908	2.549016723	0.8667255	0.05518369	1.50532617
[3,]	1.4783424	0.1660989	1.3883328	1.285395320	1.0572739	0.18812704	0.45552539
[4,]	3.4971386	0.1886511	0.8170209	0.007905699	0.3195428	0.30399271	0.09456015
[5,]	0.1005971	0.8116657	0.8318188	0.081653465	0.9489041	0.71324128	4.57249304
	[,29]	[,30]	[,31]	[,32]	[,33]	[,34]	[,35]
[1,]	0.7071711	0.22555052	0.9829550	0.5343036	0.6336374	1.8492188	0.5294955
[2,]	3.2422835	0.02718947	0.4953931	0.8541205	0.1995777	0.6609498	1.5246655
[3,]	1.0566658	2.15048668	4.5504624	0.5407806	0.8734668	1.8174565	0.4494382
[4,]	0.1843445	0.86107821	0.4612112	1.4304018	2.7018001	1.0751699	0.3261740
[5,]	1.6100692	1.14784594	0.8162658	0.3107408	1.5665106	0.8652751	1.3165009
	[,36]	[,37]	[,38]	[,39]	[,40]	[,41]	[,42]
[1,]	0.09526369	0.4921780	0.7416834	0.47638557	0.63304296	1.60341784	0.3389296
[2,]	1.41550731	0.7284614	3.7490715	0.02352585	0.34096263	0.29344082	0.1223507
[3,]	0.50526151	4.6120127	0.7263412	0.41155226	0.26260422	0.60250641	0.6761235
[4,]	0.19755939	0.2561824	0.9827498	1.91833542	0.87897058	1.23584822	0.6252936
[5,]	1.29892495	0.1380196	0.4986766	0.27147577	0.07190324	0.04386822	0.5430390
	[,43]	[,44]	[,45]	[,46]	[,47]	[,48]	[,49]
[1,]	4.3655745	0.69567209	0.1810996	4.0781775	0.4898981	0.8936707	0.1375705
[2,]	0.9926565	1.19288740	0.8772978	0.1759479	0.2294415	0.3188455	0.1413437
[3,]	0.9375448	0.56360511	0.2918547	0.3059966	0.7495303	0.1395403	0.1861139
[4,]	1.9598343	0.08368287	0.2114413	1.9708726	0.7980388	0.1127916	2.8058294
[5,]	0.3671015	0.28761857	1.4441775	1.7413550	0.1195323	2.9353781	1.0873807
	[,50]	[,51]	[,52]	[,53]	[,54]	[,55]	[,56]
[1,]	1.3150132	5.93671010	0.7518554	0.1593220	0.29971019	2.4570118	1.2574408
[2,]	4.1084876	0.32341534	3.8495864	1.2239054	0.36600557	0.2807846	0.3324520
[3,]	0.6831714	0.05968029	0.3946386	0.4534215	0.09761661	0.1039433	2.1675927
[4,]	1.8344549	1.29259653	0.6490151	1.0470811	0.01116812	2.0685849	0.5511876
[5,]	0.3704714	0.01563891	0.1284327	0.3515402	0.10328007	1.6369671	1.1381141
	[,57]	[,58]	[,59]	[,60]	[,61]	[,62]	[,63]
[1,]	0.5735232	0.56658275	0.3824755	0.4700216	1.4138544	1.02220945	1.11904686
[2,]	2.8748596	0.04415142	0.2365068	0.2598806	1.5088602	1.02639508	0.82320753
[3,]	0.4512525	1.70171772	0.2436963	1.2007086	0.6234813	0.40573995	2.20459368
[4,]	0.7081594	0.02400939	0.4702543	1.0012848	0.1143012	1.03335006	0.07613208
[5,]	1.8967549	0.34679298	1.3844285	0.1043390	1.5840989	0.08173588	1.37172667
	[,64]	[,65]	[,66]	[,67]	[,68]	[,69]	[,70]
[1,]	0.9863440	0.3126640	1.36924395	0.07256488	0.55261636	0.05900389	1.2142194
[2,]	0.9431037	0.5645905	0.95990383	0.20833844	0.09393266	1.54600656	0.7639133
[3,]	0.1992028	0.7688982	0.36840444	0.24161103	2.71356463	0.14417389	1.2505564
[4,]	0.4005981	0.1634151	0.04226451	1.83732875	0.95143043	0.96577880	1.4438457
[5,]	0.4012232	0.3592804	0.78235903	1.54424040	2.81151134	0.40383895	0.2890461
	[,71]	[,72]	[,73]	[,74]	[,75]	[,76]	[,77]
[1,]	1.769235954	1.3459590	0.09054194	0.03990244	0.9866647	1.0125326	0.2950248
[2,]	0.497972439	0.0709978	4.24164681	0.77885422	0.3629845	1.2099779	0.4345782
[3,]	0.531756779	1.1330289	5.08707090	2.48260553	1.4566483	0.1127423	0.6219801

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[4,] 0.006489544 1.2702560 1.03942124 0.01937609 0.1393136 0.9059824 0.1520874
[5,] 0.170354689 1.0963191 0.30544261 0.62346462 2.1371220 0.1773551 1.5274302
[,78]      [,79]      [,80]      [,81]      [,82]      [,83]      [,84]
[1,] 1.86175388 0.32878903 2.4733276 0.23996802 1.9461432 2.6817193 0.7915965
[2,] 3.75205195 1.36000805 0.2123644 0.33526273 0.6516714 0.8744402 1.1331946
[3,] 0.01421439 1.36075685 1.3037915 0.37840508 3.7395706 2.3113647 7.7393155
[4,] 1.08365541 0.04055022 0.7143239 0.01971689 1.5631230 0.8470533 1.2927231
[5,] 0.91765243 1.07560032 9.0041656 0.49983188 0.7749533 2.1964760 1.1123636
[,85]      [,86]      [,87]      [,88]      [,89]      [,90]      [,91]
[1,] 1.0292834 2.5652963 0.3589504 1.8500311 0.389795967 1.3424337 2.1952515
[2,] 0.4577837 1.0865262 3.5092111 0.3504006 0.697391522 1.1166742 0.7210783
[3,] 0.5595124 1.1611034 0.7687505 1.4607643 0.311435027 0.5126682 0.9645531
[4,] 3.9153136 0.1224836 1.0811963 1.5245693 1.393849950 0.9250788 0.7011619
[5,] 0.5407563 0.9707829 0.1661450 7.3904967 0.001017166 0.4137079 0.4492267
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[2,] 0.5845782 1.6923008 2.0541601 1.1799966 0.17980506 0.66440590 1.449828
[3,] 1.6608100 1.2417099 0.6686397 1.6047319 3.76131781 0.37102041 2.572073
[4,] 0.8586823 0.2329233 0.3780990 0.8480712 1.52966117 1.92115166 1.005975
[5,] 0.3384731 0.3143252 0.2223290 0.2243646 2.39305303 0.71144697 0.668872
[,99]      [,100]      [,101]      [,102]      [,103]      [,104]      [,105]
[1,] 1.4404496 2.1821179 1.9025544 2.7691269 1.4163055 1.20403995 0.36317397
[2,] 0.1595486 0.7239582 0.9384433 1.0420632 0.1386189 0.09736991 1.45040541
[3,] 0.9458718 0.2237863 2.9086061 0.1411438 1.2408414 0.04764875 4.18083622
[4,] 0.1545137 0.5089909 0.1202593 1.1158379 3.5535943 2.13459304 0.03434113
[5,] 0.6003212 1.3980600 0.5443148 0.7424547 0.7605182 1.78299815 0.20046976
[,106]      [,107]      [,108]      [,109]      [,110]      [,111]      [,112]
[1,] 1.33202955 0.881676988 0.8680883 1.6677071 1.9245254 2.4521898 1.0992675
[2,] 0.63434431 1.007995121 0.6668059 0.9125035 1.4326367 1.9531048 3.0140542
[3,] 0.00900611 0.548803975 0.1803864 0.4936293 0.8616273 0.6709810 0.1863533
[4,] 0.04735650 0.015956261 0.2458406 0.2962665 0.2599667 1.0523461 1.3211819
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[,113]      [,114]      [,115]      [,116]      [,117]      [,118]      [,119]
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[2,] 0.15095800 1.0912651 2.0421186 2.7036558 0.8311427 1.8481811 0.09380801
[3,] 0.09184244 2.0376544 0.3349219 0.1904465 2.7872343 0.1907046 1.55166937
[4,] 0.28159518 0.1086425 0.1436258 1.0855039 0.0402072 2.0193731 0.17788242
[5,] 0.20079969 3.6674197 0.8982509 0.1533483 0.6686935 0.3875524 0.15400367
[,120]      [,121]      [,122]      [,123]      [,124]      [,125]      [,126]
[1,] 2.0030043 1.2591755 1.3364258 1.3515968 0.3534147 1.6856978 0.5712193
[2,] 0.5473136 0.2633420 2.1799950 0.8053368 0.6863104 0.1691014 0.1773364
[3,] 0.2402733 0.8749470 0.1343461 1.5999157 1.2692941 0.8068888 0.7606071
[4,] 0.2878692 0.4869318 0.2901960 0.2591936 0.9155887 3.9725692 0.7949897
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[,127]      [,128]      [,129]      [,130]      [,131]      [,132]      [,133]
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[2,] 0.49944830 1.3734618 0.1701365 3.066157684 1.32380960 0.06381922 1.5409904
[3,] 0.74831547 1.5377808 0.1969086 0.004000127 1.37252416 0.63298725 2.2371572
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[,134]      [,135]      [,136]      [,137]      [,138]      [,139]      [,140]
[1,] 0.8020920 0.01826569 0.5993822 0.7172173 0.73283542 0.2336983 0.1128199
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[2,] 0.9882054 1.88695867 0.5933950 0.1860791 1.05318249 0.8598311 2.9555674
[3,] 0.2918781 1.15355183 0.3211737 0.2050036 0.08652295 0.4519374 0.5498048
[4,] 0.4018086 0.16867720 0.2362022 0.4365848 0.35768739 0.5651944 0.6155923
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[,141]    [,142]    [,143]    [,144]    [,145]    [,146]    [,147]
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[2,] 0.9884362 1.0267284 0.2997342 0.3710536 0.9188890 0.5191972 1.77583429
[3,] 0.3894757 0.4329698 0.5746602 4.5765153 0.1144353 2.3277561 0.05025552
[4,] 1.2823118 0.2923448 2.1890706 0.8067451 3.3342518 0.0784105 0.09970395
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[4,] 0.02241722 0.9603657 1.98858609 0.8402453 0.8371307 0.27839480 0.87025333
[5,] 1.87351257 1.2137061 0.71837632 1.0568010 3.1922684 0.50642042 0.07298771
[,155]    [,156]    [,157]    [,158]    [,159]    [,160]    [,161]
[1,] 0.527775846 1.4153726 0.6856476 1.2287546 0.7600245 0.23474225 6.01602922
[2,] 1.034167604 0.8640710 1.2730931 2.8766727 0.5068885 0.45314503 0.01622404
[3,] 3.091376902 1.2498716 1.0231337 0.4429972 1.3762352 0.05282568 1.35146563
[4,] 0.005928272 0.4412800 1.4174604 5.8695665 0.6166377 0.86022611 0.90965993
[5,] 0.690215219 0.1497124 0.7684965 1.5551604 1.0125323 3.44298362 0.37444102
[,162]    [,163]    [,164]    [,165]    [,166]    [,167]    [,168]
[1,] 0.0178034 2.01238521 0.5890342 0.6966560 0.43345716 3.19021470 0.8197819
[2,] 1.0163792 1.14884249 2.2543166 0.8407746 0.03276553 2.31598770 2.2951723
[3,] 1.1232385 1.26987317 0.9389621 0.9599139 4.01004364 3.51169338 0.5523896
[4,] 0.4877678 0.01793844 0.7007204 0.1630810 2.29353796 0.94029599 2.4965846
[5,] 0.5039292 1.71097755 0.1548035 0.1800742 0.39622739 0.04449872 0.1697691
[,169]    [,170]    [,171]    [,172]    [,173]    [,174]    [,175]
[1,] 1.2790692 0.2124060 0.1181336 1.63131642 1.41771185 0.5977173 0.6715881
[2,] 0.3761267 1.1976508 0.4747995 2.32477920 0.85535350 0.6212820 1.9965308
[3,] 0.5609159 1.0255399 0.9858532 0.06489567 0.73236222 2.2662909 5.0069799
[4,] 4.7264419 0.2196711 0.6465313 0.71530878 1.07074926 2.2716363 0.2097485
[5,] 1.2713201 0.1798588 1.5652137 0.55751835 0.06700925 0.4354642 0.4387487
[,176]    [,177]    [,178]    [,179]    [,180]    [,181]    [,182]
[1,] 1.6901199 2.63814991 3.49242146 0.5024934 4.0785666 1.4172478 0.1050540
[2,] 0.5189897 0.65206624 1.94466974 0.5700574 1.3899898 1.6727066 2.4276961
[3,] 0.1496266 0.03549137 0.82982565 0.2991068 0.1909755 1.2823666 0.3976543
[4,] 0.2056286 0.57844445 0.06475506 0.7537497 0.1530553 0.1234598 0.6406847
[5,] 4.5766726 0.73065795 0.02780983 0.8370747 0.4156046 0.2371819 3.5836517
[,183]    [,184]    [,185]    [,186]    [,187]    [,188]    [,189]
[1,] 0.2549786 0.8047875 0.72090091 0.1561640 0.82191222 0.1840509 1.4665286
[2,] 0.9114177 1.3002519 0.51058893 0.3791104 2.79125406 0.4776560 0.1450090
[3,] 0.3946570 0.2267927 0.08692105 0.1211351 0.13667259 0.9046700 0.6466528
[4,] 1.0845695 1.3429894 0.55621729 1.7866031 0.06294648 0.1153410 0.1192184
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[5,] 1.82559415 2.2929783 0.7204243 5.3063210 3.1595668 1.1181495
>
>
> Aux=function(x) -2*length(x)*(log(mean(x))-mean(x) +1)
> amostra
[1] 0.8 1.3 1.8 0.9 1.0
> Aux(amostra)
[1] 0.1157999
> V=apply(A,2,Aux);V
[1] 1.278500e+00 6.514839e-01 1.695523e+00 8.644749e-01 1.127566e+00
[6] 2.193667e+00 9.730240e-02 5.309465e+00 3.615570e-01 4.539823e-01
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[426] 4.409508e-01 6.513681e-01 9.660972e-01 5.027800e-02 3.472141e-01
[431] 9.711105e-01 7.878529e-03 1.385754e-01 6.743311e-01 1.109687e-01
[436] 1.218901e-01 8.589910e-01 4.152701e-01 2.707131e+00 4.621846e+00
[441] 7.709711e-01 4.461954e-01 3.872813e-01 2.636163e+00 1.773603e+00
[446] 5.402095e-01 7.441748e-01 1.211480e+00 5.343792e-01 8.829770e-01
[451] 2.407282e-01 5.406096e+00 2.159066e+00 1.534142e-02 3.670772e-02
[456] 1.641193e-01 5.188299e-03 2.038817e+00 7.685452e-01 4.040513e-01
[461] 1.225482e+00 1.832344e-01 7.459352e-01 2.855022e-01 3.290168e+00
[466] 9.448214e-01 3.002596e-01 3.173871e-01 7.617790e-02 3.443433e+00
[471] 6.879489e-01 1.062591e-01 7.758448e+00 2.868342e-03 1.403807e+00
[476] 4.678796e-01 3.961356e-03 3.365452e-02 4.703275e+00 5.895732e-02
[481] 1.260330e-02 2.920931e+00 6.307773e-01 1.076286e-01 6.613944e-01
[486] 3.287686e-03 2.042999e+00 3.979193e+00 1.049746e+00 4.158104e-01
[491] 2.155755e-02 8.013020e-01 4.256125e-02 1.155449e+00 6.009422e-02
[496] 1.687603e-03 1.104819e+00 1.081641e-02 1.760879e-01 2.203574e+00
[501] 3.115392e-02 3.222912e-01 5.429728e+00 4.040442e-02 2.260105e+00
[506] 1.814765e+00 2.374856e+00 1.838433e+00 8.430297e-01 2.203746e-01
[511] 1.427492e+00 1.083947e-01 5.381155e-01 1.158439e-01 4.026315e-01
[516] 1.636513e-01 2.038556e-01 8.440647e-01 6.105043e-01 6.288810e+00
[521] 2.228692e-01 4.000680e-02 2.270832e+00 2.072530e+00 1.228899e+00
[526] 4.587140e-01 2.791515e-01 6.654883e-01 5.389876e-01 2.762320e-01
[531] 5.181701e+00 1.355161e-02 1.638653e-02 6.565985e+00 7.035873e-02
[536] 6.649167e-01 9.476491e-04 9.585907e-03 4.732317e-01 2.027009e+00
[541] 5.193073e-01 9.269189e-01 8.866527e-01 3.071916e-02 2.413120e-01
[546] 6.816285e-02 9.747611e-01 1.721522e+00 1.983532e-01 1.469180e-03
[551] 7.130391e-02 1.608892e+00 3.130632e+00 9.303422e-01 5.140646e-01
[556] 3.209947e+00 6.594490e-01 1.578638e-01 3.393048e-01 2.704372e-02
[561] 4.684834e+00 2.247296e+00 1.080255e+00 8.188207e-01 1.408057e+00
[566] 5.490790e-02 7.731693e-02 2.512884e-01 3.029088e-04 4.538630e-03
[571] 2.522109e-01 2.965273e-01 3.349728e+00 1.334578e+00 2.254098e+00
[576] 3.215171e+00 3.982440e-02 5.549253e-01 2.968483e-01 3.642895e-01
[581] 1.242450e-01 2.288114e-01 4.181439e-01 7.160394e-01 8.938415e+00
[586] 3.055247e-01 1.772597e-01 4.590333e+00 1.732966e+00 5.764104e-01
[591] 4.622806e-02 7.470516e-03 2.691554e+00 3.899691e-01 2.242401e+00
[596] 2.445473e-01 4.369805e-01 9.009559e-01 2.387773e+00 7.495454e-01
[601] 1.661098e-03 1.771302e-02 1.159558e+00 1.724079e-05 4.042139e-01
[606] 6.840111e-04 2.949511e+00 2.806681e+00 6.244727e-02 5.802631e-01
[611] 2.580216e+00 3.233786e-01 2.245987e+00 2.823681e-03 1.621478e+00
[616] 7.904929e-01 1.258805e+00 4.755779e-01 1.948661e+00 3.565618e-01
[621] 1.330934e-02 1.012919e+00 4.517468e-01 3.096354e-01 3.745147e-01
[626] 5.404040e-01 3.935831e+00 1.263513e-02 7.088113e-01 2.157122e+00
[631] 5.454416e-01 2.783027e+00 1.459161e+00 2.323800e-02 5.461019e-04
[636] 1.001546e-01 2.499311e-01 4.585432e-01 1.494226e-01 6.801210e-01

[641] 4.111357e+00 2.574532e+00 2.629759e+00 6.942514e-01 3.238531e+00
[646] 1.977237e+00 2.772440e-04 6.249440e+00 3.859941e+00 9.009777e-01
[651] 2.981009e-04 1.172862e+00 1.072912e+00 5.957164e-01 6.311622e-01
[656] 2.763833e-01 8.573268e-01 6.424789e-01 1.660259e-02 5.558768e-03
[661] 2.968248e-02 4.984055e-01 8.177663e-01 1.804975e+00 7.205467e-02
[666] 1.334204e+00 4.996264e-01 2.991439e-01 6.945270e-01 2.875898e-01
[671] 2.123607e+00 7.524960e-03 2.783837e-01 1.303240e+00 8.628909e-01
[676] 3.417993e-01 1.291914e+00 1.449348e+00 3.994771e-03 1.286031e+00
[681] 2.258529e-02 2.375506e+00 1.687514e-05 2.014856e+00 2.153162e-01
[686] 1.694242e-01 9.022462e-01 1.404157e-01 1.934689e+00 3.760155e-01
[691] 2.386390e-01 1.976415e+00 1.512544e+00 2.153721e-01 6.341869e-01
[696] 2.403459e-01 6.457230e-02 1.187240e-03 1.881171e+00 9.791330e-03
[701] 2.287170e-01 1.663450e+00 1.394079e-01 4.728091e-04 2.722936e+00
[706] 1.176820e+00 1.088248e-01 6.925647e-02 3.288569e-01 9.584367e-02
[711] 1.451419e-01 1.081559e-01 4.323976e-01 1.744021e-01 8.637390e-02
[716] 2.034264e-01 8.871757e-01 1.700086e-01 4.220202e-01 6.610256e-02
[721] 1.015662e+00 1.871237e-01 1.062984e-01 4.404665e-02 4.112469e-01
[726] 4.329936e-01 6.551660e-02 1.944330e-01 1.331675e-02 1.191372e+00
[731] 5.981528e-02 1.653798e+00 9.677523e-03 2.338105e-01 8.727569e-01
[736] 2.948154e+00 7.621351e-01 2.223682e+00 9.010339e-03 7.073715e-01
[741] 3.762835e-02 7.243976e-01 1.813232e+00 2.958834e-01 5.207743e-01
[746] 3.845459e+00 2.332881e-01 9.878686e-02 1.911624e+00 1.668294e-03
[751] 1.107925e-01 9.500875e-01 1.921712e-01 1.993800e-01 2.650990e-03
[756] 1.258775e-02 1.188011e-01 9.799090e-02 1.409744e-01 2.948894e-02
[761] 6.158654e-01 1.956770e-02 2.308062e-01 1.629217e-01 6.236273e-01
[766] 1.753875e+00 5.319159e-01 5.608988e-01 6.180513e-01 1.838058e+00
[771] 3.678362e+00 1.166370e+00 8.550240e-02 1.095720e+00 6.733182e-01
[776] 6.559473e-01 2.350049e+00 6.725303e-01 1.457451e+00 3.496381e+00
[781] 4.738366e-01 1.454477e+00 1.749917e+00 8.520902e-03 8.795527e-01
[786] 1.731730e-01 5.428153e+00 1.000262e-01 2.993573e+00 1.387869e-02
[791] 8.308528e-02 9.002320e-03 1.536935e+00 3.319757e+00 7.217838e-01
[796] 1.384651e+00 1.467564e-01 2.945045e+00 3.128179e-01 7.690939e-02
[801] 4.115772e-01 1.358199e-02 3.113960e-01 1.969811e+00 1.595022e+00
[806] 1.490043e-01 1.512327e-02 4.169053e-01 2.479006e+00 3.050746e+00
[811] 4.791708e-02 3.403317e-02 1.145720e+00 1.490729e-01 9.146549e-01
[816] 3.407394e-02 7.520128e-03 3.990529e+00 1.002858e-02 8.616439e-01
[821] 2.640254e+00 1.655690e-02 5.236775e+00 1.296092e+00 1.488052e+00
[826] 2.521823e+00 3.933963e+00 5.621760e-01 2.689583e-01 1.893721e-01
[831] 8.734117e-02 2.150122e+00 1.669273e+00 4.843537e-01 7.175955e-01
[836] 6.015124e-01 2.614467e-01 1.836468e-01 3.403828e+00 2.545181e-02
[841] 2.653965e+00 5.194193e-01 2.067544e+00 2.368964e-03 8.563753e-01
[846] 1.051035e+00 7.729924e-01 1.539712e-01 1.741874e-02 5.555917e-01
[851] 3.312155e+00 6.396628e-03 1.284311e+00 1.616227e+01 4.114429e-01
[856] 1.774937e+00 3.759022e-02 1.341107e-02 2.673560e-01 7.100899e-01
[861] 2.963696e+00 1.303165e+00 2.282976e+00 4.482325e-01 1.755527e-01
[866] 4.618200e-01 2.899265e+00 3.426914e+00 1.713639e+00 2.015739e-02
[871] 7.717354e-03 2.097973e-01 2.257077e+00 1.309902e+00 2.414984e+00
[876] 4.960807e-01 4.025962e-01 3.620532e-03 1.363440e+00 2.099272e+00
[881] 8.908944e+00 9.192632e-01 8.042992e-02 1.106644e+00 1.046118e-01
[886] 3.007013e-02 4.631556e-01 1.636822e+00 1.479442e-01 3.447266e-02
[891] 2.376518e-01 1.935742e+00 7.837115e-01 1.969540e-01 1.488321e-03
[896] 6.762506e-02 7.985662e-03 4.515374e-01 1.210319e+00 5.015702e-02

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[901] 6.243220e-02 1.079852e+00 3.665230e+00 2.592009e-01 3.642036e-01
[906] 2.721233e+00 4.685470e-01 1.133490e-01 5.147973e+00 3.270682e-01
[911] 1.805930e-01 2.044840e-01 1.614677e-03 1.322963e-01 1.046048e+00
[916] 1.058698e+00 8.415847e-01 1.023498e+00 6.462181e-01 7.097043e-02
[921] 4.264490e-01 3.676429e-01 8.554569e-01 3.559946e-01 1.608664e+00
[926] 7.755543e-02 1.053756e+00 3.231373e-01 2.307362e-01 8.931810e-03
[931] 2.308916e-01 8.898143e-01 1.829486e-01 4.226393e-01 1.928794e-02
[936] 1.259790e-01 1.443372e+00 6.006897e-01 2.039910e+00 6.158124e-01
[941] 7.257290e-01 5.908254e-01 1.752484e+00 8.152735e-01 7.035996e-01
[946] 9.372122e-02 1.336366e+00 5.766367e-01 4.118469e-01 8.343090e-01
[951] 2.203438e+00 7.731496e-01 1.326674e-02 1.316484e-01 1.121908e+00
[956] 4.315741e-01 7.400289e-01 6.166383e-01 2.083359e-05 9.947413e-01
[961] 2.021393e-01 2.653795e+00 2.133142e-01 1.514772e-01 1.075328e-02
[966] 3.468134e-01 2.564747e+00 4.734520e-01 9.687539e-01 7.590298e-01
[971] 1.636947e+00 5.691680e-01 2.123905e+00 9.464760e-01 8.645346e-01
[976] 4.486024e-01 2.819063e+00 1.662788e-01 7.998621e-01 2.363062e+00
[981] 1.773605e+00 8.079977e-01 4.235517e-01 4.269632e-01 1.392608e+00
[986] 2.164194e-01 2.189396e-01 7.455989e-02 9.439728e-01 1.615115e-01
[991] 8.687541e-01 3.750310e-01 1.916213e-02 1.441611e-01 6.739355e-02
[996] 5.330960e-02 7.378780e+00 1.284036e+00 1.129735e+00 7.215657e-01
> mean(V);var(V)
[1] 0.9876858
[1] 1.979423
>
>
> quantile(V,0.95);qchisq(0.95,1)
95%
3.304217
[1] 3.841459
>
>
> Y=ifelse(V >qchisq(0.95,1),1,0)
> table(Y)
Y
0    1
959  41
> table(Y)/1000
Y
0      1
0.959 0.041
>
> ##P(Y=1) é uma estimativa de alfa !!!!!
>
>
> g=function(v) dchisq(v,1)
> hist(V,prob=T)
> plot(g,0,6,add=T,col="red")
>
>
>
```


Sabemos que $E(X) = 1$ e a média amostral foi 0,9877 e $V(X) = 2$ e a variância amostral foi 1,9794.