Math 3339 Name:

HW #9

Please, write clearly and justify all your steps, to get proper credit for your work.

(1)[5 Pts] Let μ be the mileage of a certain brand of tire. A sample of $n = 22$ tires is taken at random, resulting in the sample mean $\overline{x} = 29,132$ and sample variance $s^2 = 2,236$. Assuming that the distribution is normal, find a 99 percent confidence interval for μ.

(2)[5 Pts] We need to estimate the average of a normal population and from measurements on similar populations we estimate that the sample mean is $s^2 = 9$. Find the sample size n such that we are 90 percent confident that the estimate of $\overline{x}$ is within ± 1 unit of the true mean μ.

(3)[5 Pts] In comparing the times until failure (in hours) of two different types of light bulbs, we obtain the sample characteristics $n_1 = 45$, $\overline{x} = 984$, $s_x^2 = 8,742$ and $n_2 = 52$, $\overline{y} = 1,121$, $s_y^2 = 9,411$. Find an approximate 90% confidence interval for the difference of the two population means.

(4)[5 Pts] Two rubber compounds were tested for tensile strength and the following values were found

$$A: \; 32, 30, 33, 32, 29, 34, 32$$
$$B: \; 33, 35, 36, 37, 35$$

Assuming that the two populations are normally distributed and have the same variance, find a 95% confidence interval for the difference of the two population means.

(5)[4 Pts] The following commands in R computes 5000 simulations of sample means of size 12 from a normal distribution with mean $\mu = 100$ and standard deviation $\sigma = 14$.

```
require(fastR2)
nsamplesum <- do(5000) * c(sample.mean=mean(rnorm(12,100,14)))
```

The following commands compute the approximate mean and standard deviation of the sample mean and plot the histogram giving the approximate distribution of the sample mean.

```
mean(~ sample.mean, data=nsamplesum)
sd(~ sample.mean, data=nsamplesum)
gf_dhistogram(~ sample.mean, data= nsamplesum, bins=20)
```

(a) Compare the approximate values of mean and standard deviation of the sample mean found above with the expected theoretical ones.

(b) Repeat the same simulation as above using now samples from a uniform distribution in the interval $[-2, 4]$. Also in this case, run a numerical test over 5000 simulations, compute mean and standard deviation of the sample mean, and compare it to the theoretical result.

$\alpha/2$ one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
α two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
r=n-1 df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										