Problem 1:
H0: The 3 drivers have identical effects (identical mean emissions)
H1: At least one driver tends to yield larger emissions than at least one other driver
Reject H0 if T2 > 4.10 = F0.05, 2, 10
From R, T1 = 9.3636 (see below), and the F statistic is T2 = [(6-1)9.3636]/[6(3-1)-9.3636] = 17.76 > 4.10 = F0.05, 2, 10. So we reject H0 and conclude the drivers' mean emissions are not all the same.
> friedman.test(emissions, groups = driver, blocks = car)
Friedman rank sum test
data: emissions, driver and car
Friedman chi-squared = 9.3636, df = 2, p-value = 0.009262
The drivers' mean emissions are not all the same.

Multiple comparisons:

R1 = 11.0, R2 = 17.5, R3 = 7.5

[,1] [,2] [,3]
[1,] FALSE TRUE FALSE
[2,] TRUE FALSE TRUE
[3,] FALSE TRUE FALSE

Driver 2 is significantly different (higher in this case) than Driver 1 and than Driver 3.

Problem 2 (grad):
X = age for men, Y = age for women. We test H0: E(X) = E(Y) vs. H1: E(X) > E(Y) with a randomization test. The test statistic (sum of the values in the first sample (men)) is 48 in the observed sample. The p-value will differ slightly from run to run, but I got:
> print(p.value)
[1] 0.03776
based on 5000 random permutations.

This enables us to conclude the mean age is greater for men than for women.

Problem 3 (grad):
Let D = Y – X. We test H0: E(D) = 0 vs. H1: E(D) is not 0, with a randomization test. The test statistic (sum of the positive differences) in the observed sample is 3. The p-value will differ slightly from run to run, but I got:
> print(p.value)
[1] 0.28312
based on 5000 random permutations.

This is NOT enough evidence to conclude that the median difference is NOT zero.

Problem 4
Part (a)
H0: the data follow a Poisson(1.5) distribution
H1: the data do NOT follow a Poisson(1.5) distribution

One-sample Kolmogorov-Smirnov test
data: rej.eggs
D = 0.3088, p-value = 0.3555
alternative hypothesis: two-sided
We fail to reject H0. The Poisson(1.5) distribution is a reasonable model for these data.

Part (b): The confidence band is shown above in red.

Problem 5
H0: the data follow a Normal(5.6, 1.2^2) distribution
H1: the data do NOT follow a Normal(5.6, 1.2^2) distribution

One-sample Kolmogorov-Smirnov test
data: emiss
D = 0.3162, p-value = 0.145
alternative hypothesis: two-sided
We fail to reject H0. The Normal(5.6, 1.2^2) distribution is a reasonable model for these data.

Problem 6

> lilliefors.normal.pval(achieve)
H0: the data follow a Normal distribution with unspecified mean and variance
H1: the data do NOT follow a Normal distribution

$test.stat
D
0.1466985
The p-value will vary from run to run. But we should conclude the normal distribution is reasonable for these data.

**Problem 7**

H0: the data follow an exponential distribution with unspecified mean  
H1: the data do NOT follow an exponential distribution

```
lilliefors.expon.ts(spacings)
```

```
[1] 0.2155211
```

Table A15 quantile for n=15 is around 0.27.

0.2155 < 0.27, so fail to reject H0. Based on interpolating within the Table A15, the p-value appears to be somewhere around 0.20.

**Problem 8**

H0: the two samples follow the same distributions  
H1: the two samples do NOT follow the same distributions

Two-sample Kolmogorov-Smirnov test

```
data: sec1 and sec2
D = 0.75, p-value = 0.06276
alternative hypothesis: two-sided
```

Warning message:
In ks.test(sec1, sec2, alternative = "two.sided", exact = T) :
cannot compute exact p-values with ties

According the table of the exact null distribution in the back of the book, we reject H0 if T1 exceeds 27/40 = 0.675. Our T1 = 0.75 here. But in the case of ties, this table is only approximate, and so R gives the approximation P-value of 0.06276. So using the table value, we would reject H0, but using the (maybe more appropriate) approximation P-value, we fail to reject.