13.20

H_0: p1=0.28, p2=0.04, p3=0.02, p4=0.66

H_a: At least one of the proportions differs from its null hypothesized value.

E1=n*p1=435*0.28=121.8

E2=n*p2=435*0.04=17.4

E3=n*p3=435*0.02=8.7

E4=n*p1=435*0.66=287.1

Test statistic:

$\chi_c^2=\Sigma(n_i-E_i)^2/E_i$=(117-121.8)^2/121.8+(61-17.4)^2/17.4+(30-8.7)^2/8.7+(227-287.1)^2/287.1=174.17

Choose α=0.05.

χ_α^2=7.81

```
> qchisq(1-0.05,4-1)
[1] 7.814728
```

Since our test statistic is greater than χ_α^2, we reject the null hypothesis. Therefore, the members of the House of Representatives are not statistically representative of the religious affiliation of their constituents in the United States.

13.42

Let x1, x2 and x3 be the passing rates on the reading comprehension test in Texas for elementary, middle, and high school students respectively.

H_0: x1, x2 and x3 are independent.

H_a: x1, x2 and x3 are not independent.

```
> x <- matrix(c(372,418,143,44,25,10), ncol = 2)
> chisq.test(x)

        Pearson's Chi-squared test

data:  x
X-squared = 7.6599, df = 2, p-value = 0.02171
```

Since our α(0.10) is greater than the p-value(0.02), we reject the null hypothesis. Therefore, the passing rates on the reading comprehension test in Texas differ for elementary, middle, and high school students.

14.14

Let m be the median of the population.

H_0: m=10

H_a: m<10

S_B = number of sample measurements below 10 = 6

S_A = number of sample measurements above 10 = 7

Test statistic S = S_B= 6

p-value = P(x>=6)=1-P(x<=5)=0.709

```
> 1-pbinom(5,13,p=0.5)
[1] 0.7094727
```

Since our α (0.10) is smaller than the p-value (0.709), we cannot reject the null hypothesis when α = 0.10. Therefore, the given statement is supported by the data.

14.50

Let D1 be the crash data before the installation of red light cameras. Let D2 be the crash data after the installation of red light cameras.

H_0: D1=D2

H_a: D1 shifted to the right of D2

Choose α=0.05. Since our α (0.05) is smaller than the p-value (0.011), we reject the null hypothesis when α = 0.05. Therefore, the photo-red enforcement program effective in reducing red-light-crashing incidents at intersections.