1)

```
proc glm;
class runner brand;
model force = runner brand;
random runner / test;
run;
```

```
The GLM Procedure
Tests of Hypotheses for Mixed Model Analysis of Variance

Dependent Variable: Force

Source                     DF    Type III SS    Mean Square   F Value   Pr > F

Runner                      9         528364          58707      2.04   0.0732
Brand                       3        5520700        1840233     64.06   <.0001

Error: MS(Error)           27         775646          28728
```

Because the p-value for Brand is 0.000, we can conclude there is a significant difference in the four brands of shoes with respect to their main peak force.
To run this experiment as a completely randomized design, the experimenter would need 40 runners. Each runner would be randomly assigned one of the four brands of shows with 10 assigned to each brand. The problem of a completely randomized design is that the variability among runners may be much larger than the variability between runners. The benefit of a completely randomized design is there would be no possible "carryover" effect as each runner only uses one type of shoe.

The conditions for using the test in part a would be assuming the responses from each runner are independent from the responses of the other runners. Also, it must be assumed that the covariance of two observations on the same runner is constant across runners.

Using only experienced long distance runners – limits the application of the results …