Question 2.1

a. Table below

Source	df	SS	MS	F	p-value
Among Groups	**7**	**35819**	**5117**	**3.5**	0.0099
Within Groups	24	35088	**1462**		
Total	31	70907			

df_{among} and SS_{among} come from subtracting the within value from the total value. MS_{among} comes from SS_{among} divide by df_{among}. F is then MS_{among} divided by MS_{within}. Finally the p-value comes from `distrib(3.5,distrib="f",df1=7,df2=24,lower.tail=FALSE)`.

b. The number of groups = 7+1 = 8 (i.e., df_{among}+1).
c. The number of individuals = 31+1 = 32 (i.e., df_{total}+1).
d. The variability among individuals within groups is $s_p^s = MS_{within} = 1462$.
e. The variabilty among individuals ignoring groups is $s^2 = MS_{total} = \frac{70907}{31} = 2287.3$.
f. Yes, there is a difference among the group means because the p-value is less than 0.05.

Question 2.2

a. Table below

Source	df	SS	MS	F	p-value
Among Groups	**3**	17.25	**5.75**	1.26	0.3149
Within Groups	**20**	**91.20**	4.56		
Total	23	**108.45**			

MS_{among} comes from multiplying F and MS_{within}. df_{among} then comes from dividing SS_{among} by MS_{among}. df_{within} then comes from df_{total}-df_{among}. SS_{within} is then MS_{within} times df_{within}. SS_{total} is then $SS_{among} + SS_{within}$. Finally the p-value comes from `distrib(1.26,distrib="f",df1=3,df2=20,lower.tail=`

b. The number of groups = 3+1 = 4 (i.e., df_{among}+1).
c. The number of individuals = 23+1 = 24 (i.e., df_{total}+1).
d. The variability among individuals within groups is $s_p^s = MS_{within} = 4.56$.
e. The variabilty among individuals ignoring groups is $s^2 = MS_{total} = \frac{108.45}{23} = 4.72$.
f. No there is not a difference among the group means because the p-value is greater than 0.05.

Question 2.3

a. Table below

Source	df	SS	MS	F	p-value
Among Groups	5	887.05	177.41	5.25	0.0006
Within Groups	48	1621.44	33.78		
Total	53	2508.49	*47.33*		

Note that MS_{total} and MS_{within} were given by definition. The df_{among} and df_{total} were given by knowing the number of groups and total number of individuals. The SS are then obtained, the final MS, and the F. The p-value is computed with `distrib(5.25,distrib="f",df1=5,df2=48,lower.tail=FALSE)`

b. Yes, there is a difference among the group means because the p-value is less than 0.05.