(1) **Let's say we are interested in the effect that automated election calls have on election outcomes. If we ask a group of people who received these calls and a group who did not receive these calls who they voted for, is this study an experiment? Why or why not?**

This is not an experiment as the researcher had no control over who was assigned to the treatment group (received a phone call) and who was in the control group (did not receive a phone call). From the question we do not know how the calls were placed. Thus, the study is not experimental but observational.

(2) **What role does randomization play in guaranteeing the internal validity of an experiment?**

Randomization is the key component of any well-founded experiment. Only when there is good reason to expect that the treatment and control groups are exactly alike can we hope to obtain valid results from an experiment. Random assignment to groups is the only way to guarantee "exactly alike"-ness, as there are countless observable and unobservable factors which may be involved. If one is not able to say that the treatment rather than some difference between the treatment group and control groups caused some outcome, the internal validity of the experiment is diminished.

(3) **Chapter 2 Review Exercises (pp. 24-27)**

4 (a) The separation of study participants by age group and gender was undertaken to make sure that comparisons between smokers and non-smokers were made between otherwise comparable groups of individuals. Comparing a group of 80 to 85–year–old non–smoking women to 25 to 30–year–old male smokers would likely have shown that the smokers in this comparison were healthier than the non-smokers. Yet, such a result would be driven not by the fact that one group consisted of smokers and one of non–smokers, but simply on the fact that younger people are on average healthier than older people. Likewise, there are health differences that are based purely on gender, so that men and women were studied (compared) separately. In other words, confounding is a potentially large threat to the study's validity unless one controls for age and gender.

(b) The most likely explanation for the fact that those who recently stopped smoking were less healthy as a group than their smoking peers is that the group of recent non–smokers contains all those people who stopped smoking for health reasons. In some cases, the health of those who stopped smoking might have been so bad that they had to stop smoking even though they did not necessarily want to do so. The people who became non–smokers because they were so ill that they had to stop smoking, did not witness their health deterioration as a consequence of their decision to quit smoking, but rather that their bad health made them stop smoking. Notice, smoking was not randomly assigned. Researchers could not choose who was given the 'treatment'.

8 To answer this question, a look at the calendar is needed. Memorial day is on May 30, while Labor Day is celebrated on the first Monday in September (September 7 in 2009). Thus, in 2009 the time between these two holidays (not including either day) was $1 + 30 + 31 + 31 + 6 = 99$ days. Now, 99 days make up $99/365 = 27.12\%$ of the year. Hence, the statistics do not prove that burglars go to work when other people go on vacation. In fact, for 2009 the summer time sees slightly below average levels of burglaries (25% of all burglaries in 27.12% of the days of the year).

9 (a) False. The observational studies lead one to believe that people who get lots of vitamins will be less likely to die from cancer. Yet, the experiments found no relationship between vitamin intake and death from colon cancer and a *positive* relationship between vitamin intake and lung cancer, i.e., those people who get lots of vitamins were more likely to die from lung cancer, not less.

(b) This is correct; the results from the observational study are likely wrong due to confounding. People who eat lots of vegetables, which happen to contain vitamins, are likely to differ from people who do not, and the observational study may not have adequately "controlled" for this effect. Generally, one can assume that the diet and maybe also lifestyle of the people who eat lots of fruit and vegetables will be healthier overall, leading to the finding that they are less likely to die from colon or lung cancer than those who do not eat fruits

and vegetables regularly. In this case, there is an *association* between diets that include fresh fruit and vegetables and the incidence of colon and lung cancer, but this does not establish a causal relationship.

(c) False. In the experiment, confounding should not have played a notable role. If the experiment was well-designed, the setup should have controlled for lifestyle differences, and the treatment and control groups should have been comparable in every respect except for the participants' intake of vitamins via diet supplements.

12 False. In some circumstances, the mechanism described may not hold. Technically, this is known as "Simpson's Paradox" or "Simpson's Reversals of Inequalities." Here's a numerical example from the *Stanford Encyclopedia of Philosophy* that shows that the statement made in the question can be false.[1] For simplicity, let's assume we have just two wards and 13 registered Democratic voters as well as 13 registered Republican voters in the city. Now:

	# reg. Dem's who vote / all reg. Dem's in ward(s)		# reg. Rep's who vote / all reg. Rep's in ward(s)
Ward 1	2 / 8 (25%)	$>$	1 / 5 (20%)
Ward 2	4 / 5 (80%)	$>$	6 / 8 (75%)
City	6 / 13 (46%)	$<$	7 / 13 (54%)

As one can see, even though the percentage of registered Democrats who voted is higher in each ward, for the city as a whole it is lower.

[1] See http://plato.stanford.edu/entries/paradox-simpson/ for more information.