Unit 3 & 4 Assignment Solutions

1. (a) (i) simple random sample
   (ii) There is no bias involved with the sampling method.

   (b) (i) voluntary response sample
   (ii) Only people who feel strongly about the issue will take the time to respond. The sample will therefore not be representative of the population.

   (c) (i) multistage random sample
   (ii) There is no bias involved with the sampling method.

   (d) (i) convenience sample
   (ii) The sample may not be representative of the population. The representative is more likely to ask friendly-looking people who don't seem to be in a rush. He or she also may tend to select certain types of people to ask (perhaps more females than males, for example).

   (e) (i) stratified random sample
   (ii) There is no bias involved with the sampling method.

   (f) In this situation, the multistage sample makes the most sense. The simple random sample and stratified random sample would be very time-consuming and probably not practical. It would be much more difficult to contact students one-by-one than to administer a survey to an entire class.

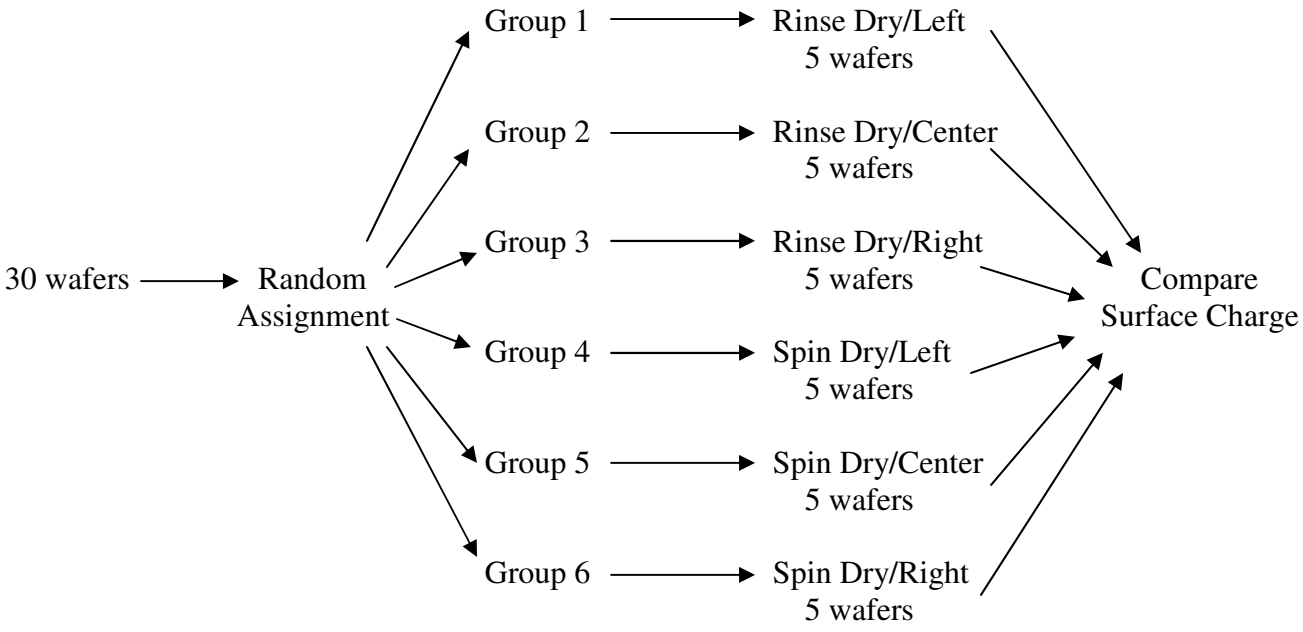
2. (a) This is an observational study, not an experiment, and so we cannot conclude that it is the anaesthetic that is the cause of the higher death rate. There are several potential lurking variables.

   (b) Some possible lurking variables (there may be others):

   - Different **doctors** may use different anaesthetics.
   - Different **hospitals** may use different anaesthetics.
   - The anaesthetic used may depend on the **age** of the patient.
   - The anaesthetic used may depend on the **severity of the patient's condition**.
   - The anaesthetic used may depend on the **type of operation**.

3. You have been asked to develop an experiment to meet the objectives for each of the following scenarios. For each of the studies, answer the following questions:

(a) (i) A completely randomized design should be used.
(ii) The experimental units are the 30 silicon wafers.
(iii) The factors are the cleaning method and the position where the charge was measured.
(iv) Cleaning method has two levels – rinse dry and spin dry. Position has three levels – left, center and right.
(v) There are six treatments – rinse dry/left, rinse dry/center, rinse dry/right, spin dry/left, spin dry/center and spin dry/right.
(vi) There is no blocking variable in this experiment.
(vii) A diagram illustrating the design of this experiment is shown below:



(b) (i) A randomized block design should be used.

(ii) The experimental units are the 24 samples of chemical solution.

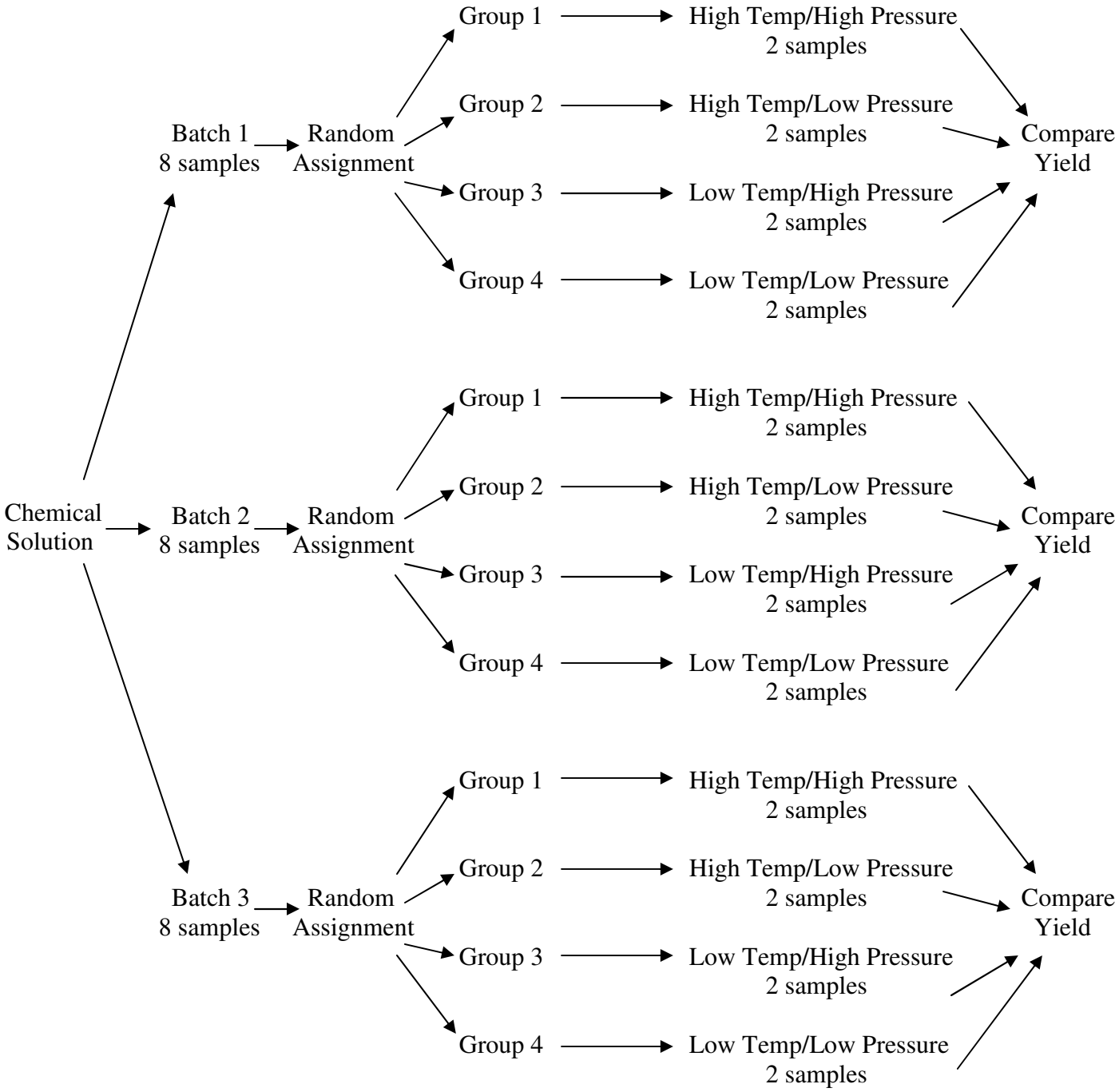
(iii) The factors are the temperature and pressure.

(iv) Temperature two levels – high and low. Pressure also has two levels – high and low.

(v) There are four treatments – high Temperature/high Pressure, high Temperature/low Pressure, low Temperature/high pressure and low temperature/low pressure.

(vi) The blocking variable batch of chemical solution.

(vii) A diagram illustrating the design of this experiment is shown below:



4. Each runner will run the 1500-meter race twice during the day, once wearing one model of running shoe and the other time wearing the other model. Which model they wear for the first race will be randomly determined (say, by tossing a fair coin). The runners should be given sufficient time between races so that they can still perform at their full potential in the second race. Times will be compared for the two models of shoe for each runner. If we didn't randomly decide which model of shoe each runner would wear first, and say, each runner wore the first model in the first race and the other model in the second race, then fatigue could be a lurking variable. If times were better for the first model, we wouldn't know whether it was because of the model of running shoe, or if it was because runners were tired from the first race.