Due Date: November 5th, 2019
Problems due: 2,3(a)

1. Let $g : \mathbb{R} \to [0, \infty)$ and $f : \mathbb{R} \to [0, \infty)$ are two probability density functions such that

$$f(x) \leq g(x), \quad \forall x \in \mathbb{R}.$$

   Consider the following Acceptance-Rejection Algorithm:-

   (a) Generate a sample Y having density g.

   (b) Generate a sample U from Uniform$(0, 1)$.

   (c) If $U \leq \frac{f(Y)}{g(Y)}$ then set $X = Y$, else repeat step (a).

   Show that X has probability density function f.

2. Using the Acceptance-Rejection Algorithm described above

   (a) Write a function in `R`, called `mybeta` to generate sample of Beta(2,4).

   (b) Perform 1000 replications using `mybeta` and plot the histogram.

   (c) On the same plot : plot the Beta$(2, 4)$ using the `dbeta` command and also plot the Kernel Density estimate from the histogram.

3. *Feedback on Hw5:* The mathematics of the report was okay for most of you but the writing of it was not up to the mark. In this problem we will enhance the report by using the detailed dataset `babiesIII.data`.

   (a) Please do the following computations[1] and add them appropriately to your hw5.Rnw and place it separately as hw5and11.pdf :-

      i. When we compared the babies of smokers to those of nonsmokers, we found a difference of in their average birth weights. How does this difference compare to the difference between the birth weight of babies who are firstborn and those who are not? What about the birth weights of babies born to mothers who are above the median in height or weight and babies born to mothers who are below the median in height or weight?

      ii. Recall that we also found that the spread and shape of the birth-weight distribu- tions for the babies born to smokers and nonsmokers were quite similar. How do the birth-weight distributions compare for the groupings of the babies by parity, mother's height, or weight?

      iii. Set aside the information as to whether they smoke or not, and divide the mothers into many groups where within each group the mothers are as similar as possible. For example, take into account a mother's height, weight, and parity when placing her in a group. Although the mothers within a group are similar in many respects, they may differ according to whether the mother smokes or not and by other characteristics as well. Within each group, compare the birth weights of babies born to smokers and nonsmokers. Do you see any patterns across groups?

      iv. Another way to compare the effect of a mother's smoking on birth weight to the effect of her height on birth weight is to see if the variation in birth weight is related to these factors and, if so, in what way. First, consider the standard deviation of birth weight for all babies. Determine how much it is reduced when we take into consideration whether the mother smokes or not. To do this, for babies born to smokers, find the root mean square (r.m.s.) deviation in birth weight. Compare this to the r.m.s. deviation in birth weight for babies born to nonsmokers. If they are roughly the same, then they can be pooled to get a single r.m.s. deviation of each baby's birth weight from the average birth weight for its group.

      v. We can also see how the deviation in birth weight varies with mother's height. The babies can be split into groups, where each group consists of those babies whose mothers have the same height to the nearest inch. For each group, the remaining variation in birth weight can be computed using the r.m.s. deviation in birth weight about the group average. If the deviations do not

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[1]from the book STAT LABS, page 202

vary much across groups, then they can be combined to form a single r.m.s. deviation in birth weight given mother's height. This single measurement of variation in birth weight can then be compared to the variation remaining in birth weight given the mother's smoking status. These types of comparisons are useful in determining the relative importance of smoking versus other factors that may affect birth weight.

(b) *Extra for Credit Replacement*[2] Write a complete report on your understanding of the dataset. Please refer to the instructions given on page 251-257 in the book. Please place the report as finalbabiesreport.pdf by November 5th, 2019.

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[2]This part is not due as part of the hw5and11.pdf. The report will be graded and I will replace the two lowest quiz scores with the scores from the grade obtained by the report.