STAT 356 Case Study : Restaurant Tipping

1 Description

Foodserver's tips in restaurants may be influenced by many factors including the nature of the restaurant, size of the party, table locations in the restaurant, ... To make appropriate assignments (which tables the food server waits on) for the foodservers, restaurant managers need to know what these factors are. For the sake of staff morale they must avoid either the substance or appearance of unfair treatment of the foodservers, for whom tips are a major component of pay. In one restaurant, a foodserver recorded the following data on all customers they had served during a interval of two and a half months in early 1990. The restaurant, located in a suburban shopping mall, was one of a national chain and served a varied menu. In observance of local law the restaurant offered seating in a non-smoking sections to patrons who requested it. The data was assigned to those days and during those times when the foodserver was routinely assigned to work.

The data available are:

TOTBILL	Total bill, including tax, in dollars
TIP	Tip in dollars
SEX	Sex of person paying bill (0=male, 1=female)
SMOKER	Smoker in party? (0=No, 1=Yes)
DAY	3=Thur, 4=Fri, 5=Sat, 6=Sun
TIME	0=day, 1=night
SIZE	Size of the party

This is a great data set in many ways because it is clearly a pilot study. There should be no temptation to make inference from the data, and emphasis should be on poking around the data to formulate hypotheses, and design a careful study.

2 Suggested Approaches

Approach	Reason	Type of questions addressed
Data Restructuring		
Make new variable Tip Rate from Tip/Total	Tip is usually referred to by percentage points, or as a rate. This also 'calibrates' the variable according to the bill total and allows us to compare values across the other variables such as size of the party.	
Make dummy variable for day of the week	This is a categorical variable so it is not appropriate to treat it as an ordinal value. This is especially important for a regression analysis.	
Summary statistics (marginal and conditional)	extract location/scale information	"What is the average tip rate at the restaurant?", "Are tips higher on Saturdays than on Thursdays?", "What is the average party size?"

Histograms (with different bin widths)	explore univariate distributions	Are there unusual patterns in the tipping behavior?" ([redacted] distribution shape, quirky structures)
Pairwise Scatterplots (marginal and conditional)	explore bivariate distribution and correlation structure	"Are there unusual patterns in the tipping behavior?"
Regression	Determining the most important factors to tip rate	"Which factors contribute to higher tips?"

We don't have to do anything really sophisticated with this data. It is almost entirely categorical except for tip and total bill. So we will make extensive use of conditional plots.

3 Actual Approaches

3.1 Summary Statistics

Number of Observations = 244, Number of Variables = 7.

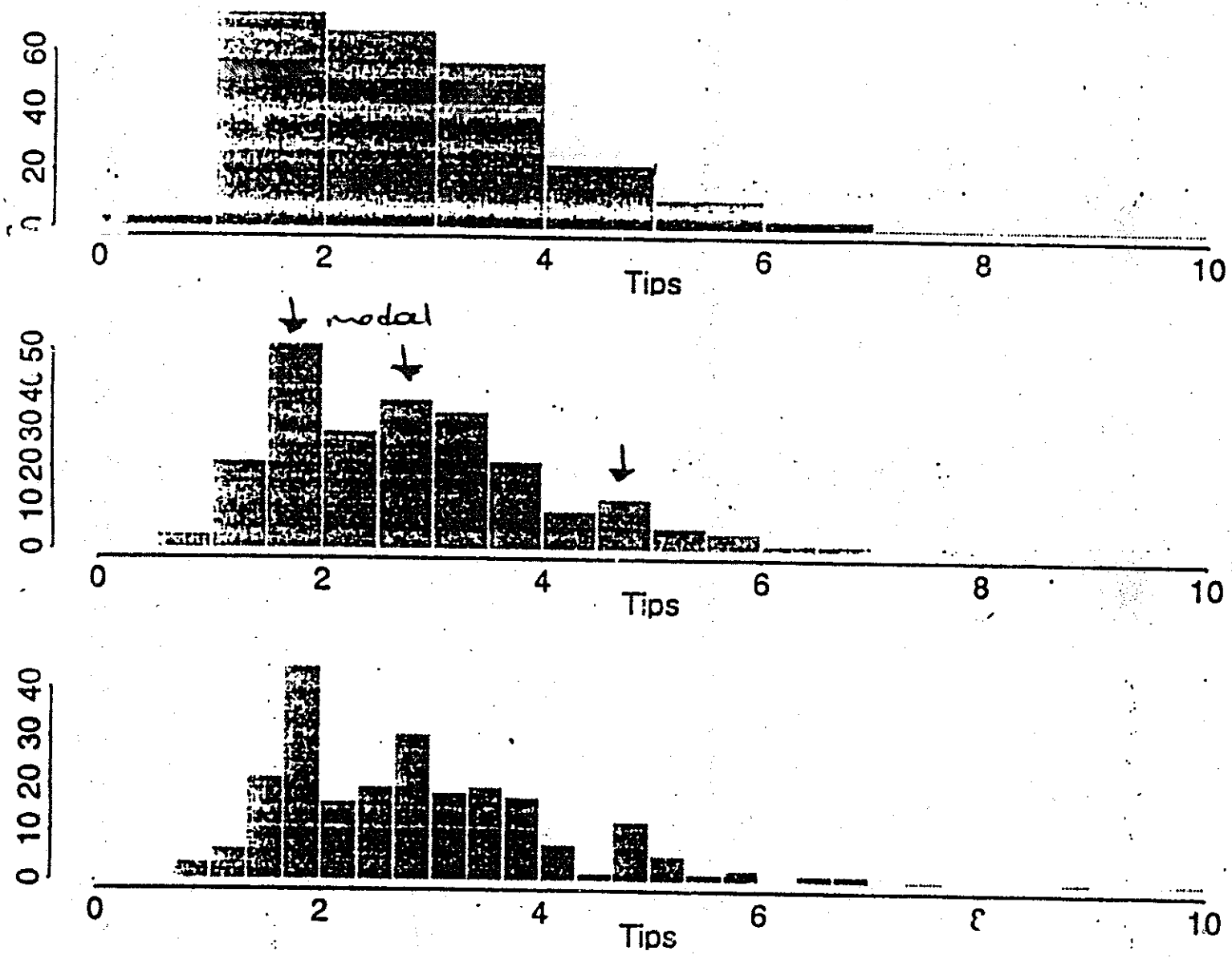
	TOTBILL	TIP	TIPRATE	SEX	SMOKER	TIME	SIZE
Mean	\$19.78	\$3.00	16.1%	0.36	0.38	0.72	2.57
SD	\$8.90	\$1.38	6.1%	0.48	0.49	0.45	0.95

# of males > # of females paying the bill

Tip Rate (Total Number)	Thurs	Fri	Sat	Sun
Total	16.1 (62)	17.0 (19)	15.3 (87)	16.7 (76)
Day	16.1 (61)	18.9 (7)	0	0
Night	16.0 (1)	15.9 (12)	15.3 (87)	16.7 (76)

Tip Rate (Total Number)	Male	Female	Total
Non-Smoker	16.1 (97)	15.7 (54)	15.9 (151)
Smoker	15.3 (60)	18.2 (33)	16.3 (93)
Total	15.8 (157)	16.6 (87)	16.1 (244)

Size of Party	1	2	3	4	5	6
Tip Rate (Total Number)	21.7 (4)	16.6 (156)	15.2 (38)	14.6 (37)	14.1 (5)	15.6 (4)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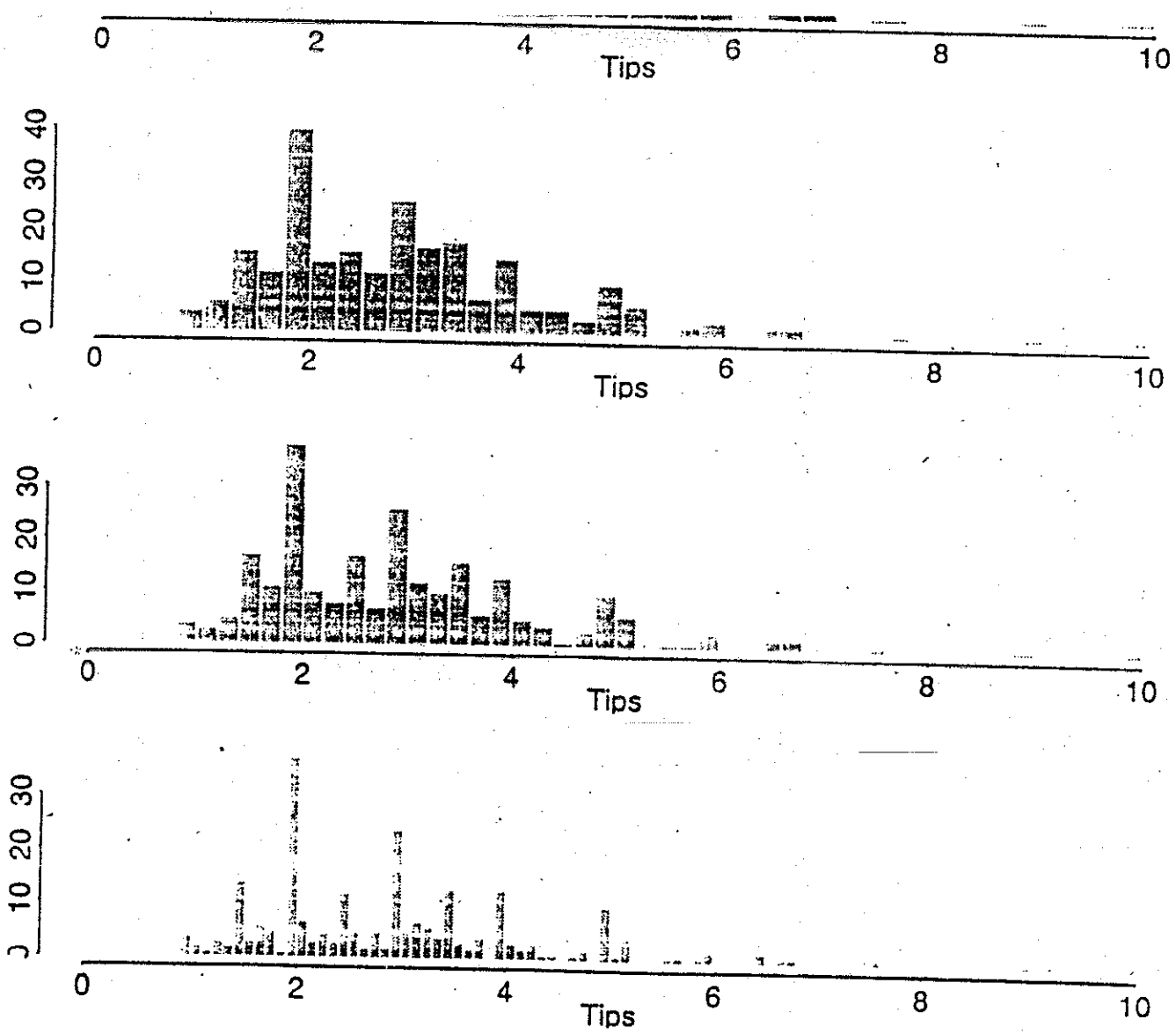
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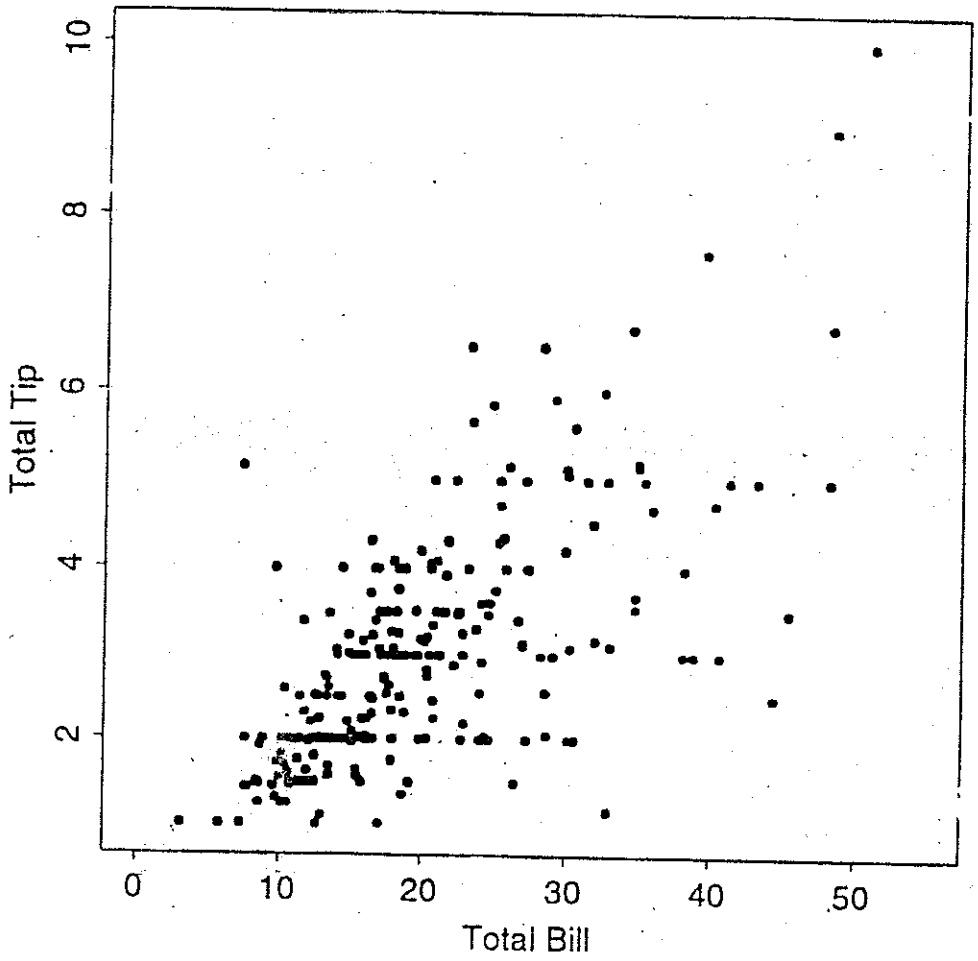

Figure 2: Scatterplot of Total Tip vs Total Bill. More points in the bottom right indicate more cheap tippers than generous tippers.

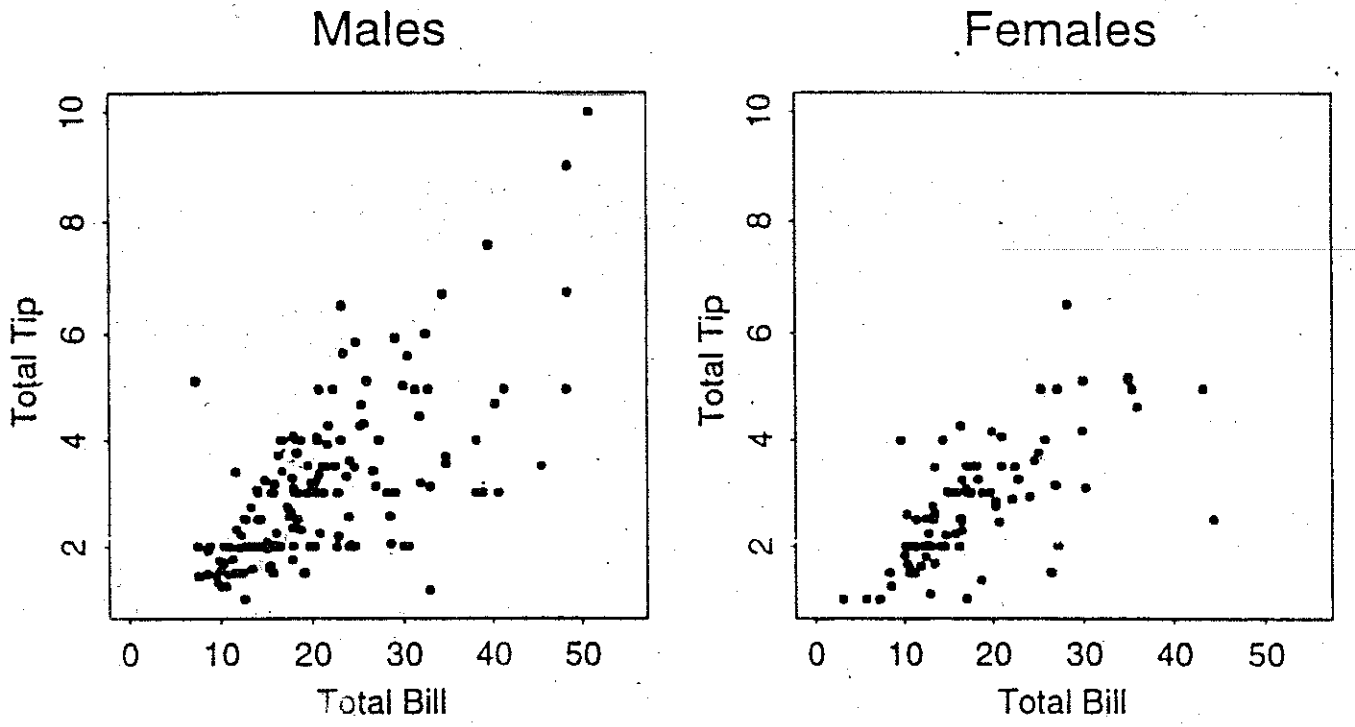

Figure 3: Scatterplot of Total Tip vs Total Bill by Sex.

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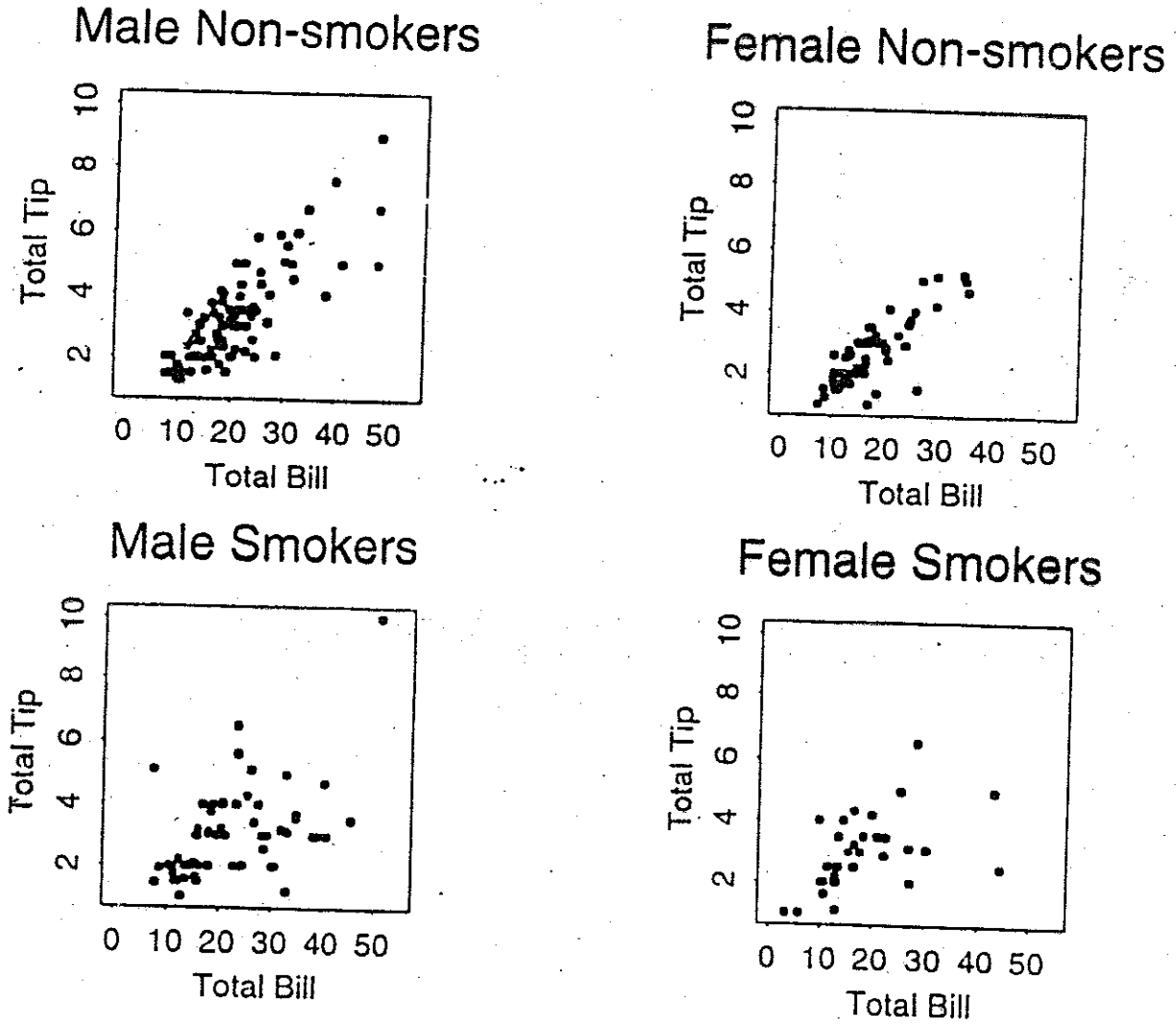
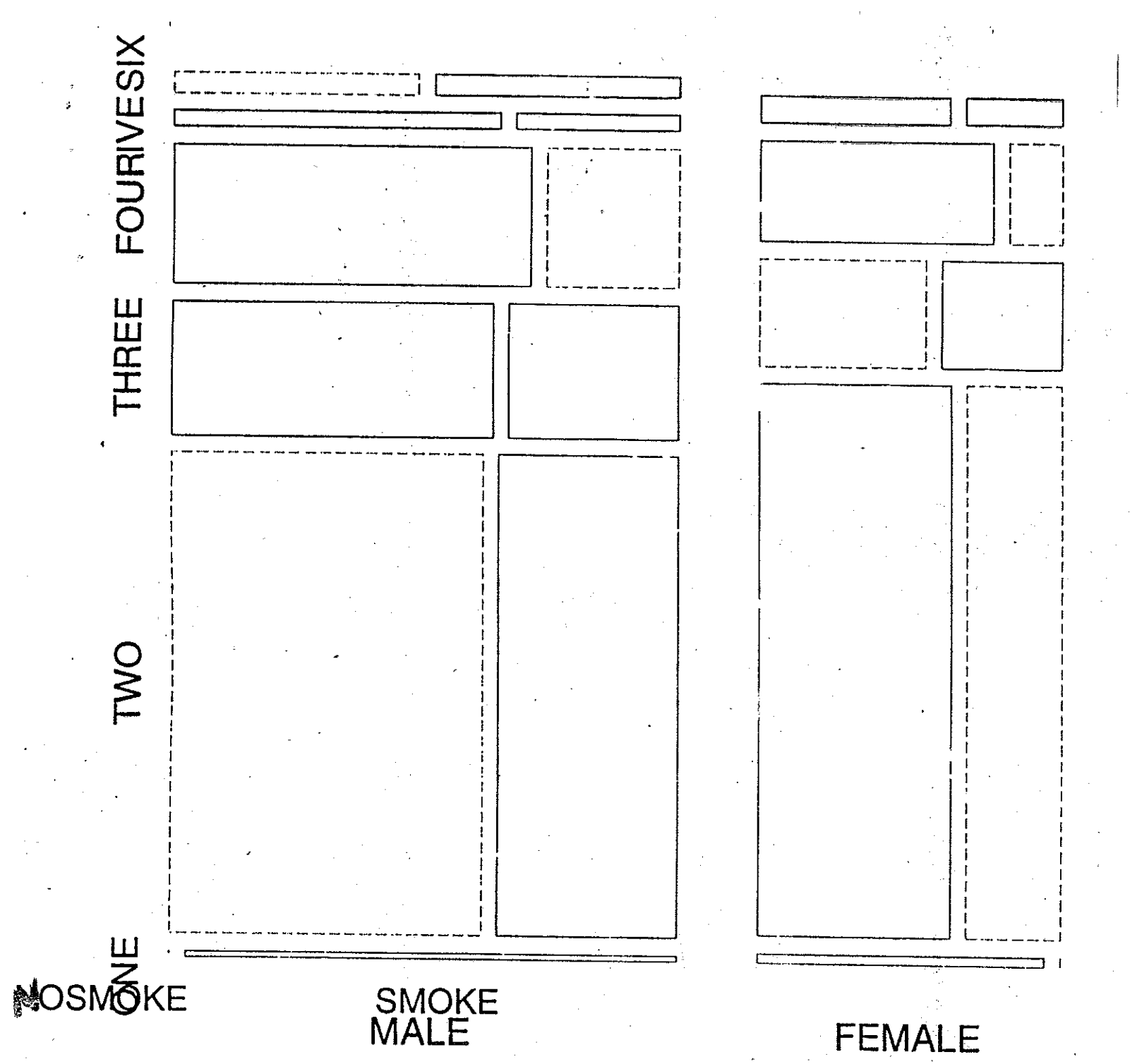


Figure 4: Scatterplot of Total Tip vs Total Bill by Sex and Smoker.


FOUR
FIVE
SIX
THREE
TWO
ONE
NO SMOKE
SMOKE
MALE
FEMALE