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4.23 (a) The sum of the six counts is 10+9+24+61+206+548 = 858 people. (b) The sum of the top row shows 10+9+24 = 43 people had arthritis. (c) The marginal distribution of participation in soccer is shown below.

	Elite	Non-elite	Did not play
Count	71	215	572
Percent	8.3%	25.1%	66.7%

(d) The percent of each group who have arthritis is 14.08% for the elite soccer players, 4.2% for the non-elite soccer players and 4.19% for the people who did not play. This suggests an association between playing elite soccer and developing arthritis.

4.24 The percents should add to 100% because they provide a breakdown of all participants according to one categorical variable. The sum is 8.3% + 25.1% + 66.7% = 100.1 %. If one more decimal place is included in each of the percents, then the sum is 8.28% + 25.06% + 66.67% = 100.01%. The percents do not add to 100% because of rounding.

4.25 (a) The sum of the six counts is 5375 students. (b) The proportion of these students who smoke is 1004/5375 = 0.1868, so the percent of smokers is 18.68%. (c) The marginal distribution of parents smoking behavior is shown below.

	Neither parent smokes	One parent smokes	Both parents smoke
Count	1356	2239	1780
Percent	25.23%	41.66%	33.12%

(d) The three conditional distributions are shown in the table below.

	Neither parent smokes	One parent smokes	Both parents smoke
Student does not smoke	86.14%	81.42%	77.53%
Student smokes	13.86%	18.58%	22.47%

The conditional distributions reveal what many people expect—parents have a substantial influence on their children. Students that smoke are more likely to come from families where one or more of their parents smoke.

4.26 (a) The two-way table is shown below. (b) The percent of eggs in each group that hatched are 59.26% in a cold nest, 67.86% in a neutral nest, and 72.12% in a hot nest. The percents indicate that hatching increases with temperature. The cold nest did not prevent hatching, but made it less likely.

	Cold	Neutral	Hot
Hatched	16	38	75
Not hatched	11	18	29
Total	27	56	104

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4.31 The table below gives the two marginal distributions. The marginal distribution of marital status is found by taking, e.g., 337/8235 ≐ 4.1%. The marginal distribution of job grade is found by taking, e.g., 955/8235 ≐ 11.6%.

Single	Married	Divorced	Widowed
4.1%	93.9%	1.5%	0.5%
Grade 1	Grade 2	Grade 3	Grade 4
11.6%	51.5%	30.2%	6.7%

As rounded here, both sets of percents add up to 100%. If students round to the nearest whole percent, the marital status numbers add up to 101%. If they round to two places after the decimal, the job grade percents add up to 100.01%.

4.32 The percent of single men in grade 1 jobs is 58/337 ≐ 17.21%. The percent of grade 1 jobs held by single men is 58/955 ≐ 6.07%.

4.33 Divide the entries in the first column by the first column total; e.g., 17.21% ≐ 58/337. These should add to 100% (except for rounding error). The percentages in the table below add to 100.01%.

Job grade	% of single men
1	17.21%
2	65.88%
3	14.84%
4	2.08%

If the percents are rounded to the nearest tenth, 17.2%, 65.9%, 14.8%, and 2.1%, then they add to 100%.

4.34 (a) We need to compute percents to account for the fact that the study included many more married men than single men, so that we would expect their numbers to be higher in every job grade (even if marital status had no relationship with job level). (b) A table of percents is below; descriptions of the relationship may vary. Single and widowed men had higher percents of grade 1 jobs; single men had the lowest (and widowed men the highest) percents of grade 4 jobs.

Job grade	Single	Married	Divorced	Widowed
1	17.21%	11.31%	11.90%	19.05%
4	2.08%	6.90%	5.56%	9.52%