TECHNOLOGY TOOLBOX   *Goodness of fit tests on a calculator (continued)*

```
WINDOW
 Xmin=0
 Xmax=14
 Xscl=1
 Ymin=-.1
 Ymax=.3
 Yscl=.1
 Xres=1
```

```
ShadeX²(5.742,1E99,3)
```

Area=.12486   df=3
low=5.742   up=1E99

```
F1▼  F2▼
Tools Zoom
xmin=0.
xmax=14.
xscl=1.
ymin=‾.1
ymax=.3
yscl=.1
xres=1.
MAIN   RAD AUTO   FUNC
```

```
F1▼  F2▼  F3▼  F4▼  F5   F6▼
Tools Algebra Calc Other PrgmID Clean Up

■ tistat.shadchi2    (5.742,1.▶
                        Done
..t.shadChi2(5.742,1E99,3)
MAIN   RAD APPROX   FUNC 1/30
```

```
F1▼ F2▼ F3  F4   F5▼ F6▼ F7▼
Tools Zoom Trace Regraph Math Draw Pen

Area=.12486
low=5.742   up=1.E99
MAIN   RAD APPROX   FUNC
```
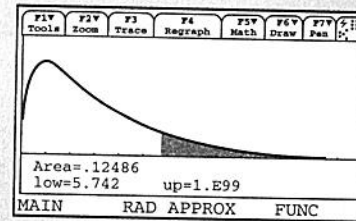
The shaded area, 0.1248, matches the *P*-value we found using χ^2 cdf.

EXERCISES

13.1 FINDING *P*-VALUES

(a) Find the *P*-value corresponding to $X^2 = 1.41$ for a chi-square distribution with 1 degree of freedom: (i) using Table E and (ii) with your graphing calculator.

(b) Find the area to the right of $X^2 = 19.62$ under the chi-square curve with 9 degrees of freedom: (i) using Table E and (ii) with your graphing calculator.

(c) Find the *P*-value corresponding to $X^2 = 7.04$ for a chi-square distribution with 6 degrees of freedom: (i) using Table E and (ii) with your graphing calculator.

13.2 ARE YOU MARRIED? According to the March 2000 Current Population Survey, the marital status distribution of the U.S. adult population is as follows:

Marital status:	Never married	Married	Widowed	Divorced
Percent:	28.1	56.3	6.4	9.2

A random sample of 500 U.S. males, aged 25 to 29 years old, yielded the following frequency distribution:

Marital status:	Never married	Married	Widowed	Divorced
Frequency:	260	220	0	20

Perform a goodness of fit test to determine if the marital status distribution of U.S. males 25 to 29 years old differs from that of the U.S. adult population. Use the Inference Toolbox.

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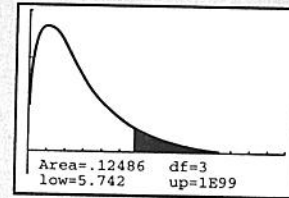quency dist

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13.3 GENETICS: CROSSING TOBACCO PLANTS Researchers want to cross two yellow-green tobacco plants with genetic makeup (Gg). Here is a Punnett square for this genetic experiment:

	G	g
G	GG	Gg
g	Gg	gg

This shows that the expected ratio of green (GG) to yellow-green (Gg) to albino (gg) tobacco plants is 1:2:1. When the researchers perform the experiment, the resulting offspring are 22 green, 50 yellow-green, and 12 albino seedlings. Use a chi-square goodness of fit test to assess the validity of the researchers' genetic model.

13.4 In recent years, a national effort has been made to enable more members of minority groups to have increased educational opportunities. You want to know if the policy of "affirmative action" and similar initiatives have had any effect in this regard. You obtain information on the ethnicity distribution of holders of the highest academic degree, the doctor of philosophy degree, for the year 1981:

Race/ethnicity	Percent
White, non-Hispanic	78.9
Black, non-Hispanic	3.9
Hispanic	1.4
Asian or Pacific Islander	2.7
American Indian/Alaskan Native	0.4
Nonresident alien	12.8

A random sample of 300 doctoral degree recipients in 1994 showed the following frequency distribution:

Race/ethnicity	Count
White, non-Hispanic	189
Black, non-Hispanic	10
Hispanic	6
Asian or Pacific Islander	14
American Indian/Alaskan Native	1
Nonresident alien	80

(a) Perform a goodness of fit test to determine if the distribution of doctoral degrees in 1994 is significantly different from the distribution in 1981. Note: Although two expected counts are less than 5, the chi-square test still gives adequate results in this setting.

(b) In which categories have the greatest changes occurred, and in what direction?

13.5 M&M'S ACTIVITY Use the class M&M's data that you recorded in steps 6 and 7 of Activity 13 to answer the following questions. Consider the entire count of M&M's in the class as one large sample from the production process.

(a) Do these data give you reason to doubt the color distribution of M&M's candies advertised by the M&M/Mars Company? Give appropriate statistical evidence to support your conclusion.