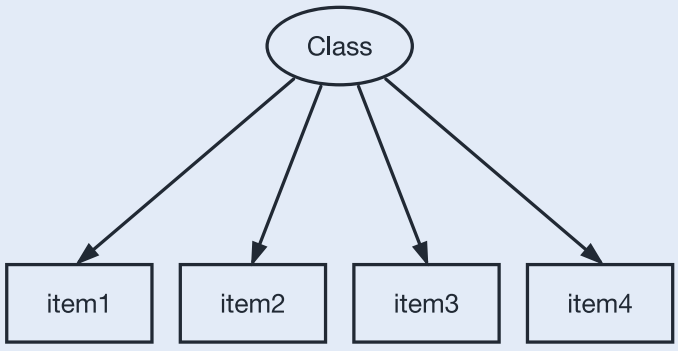
Latent class analysis (LCA)

Discover and understand the unobserved groupings in your data—consumers with different buying preferences, adolescents with different patterns of behavior, individuals with different health status classifications ...

Determine who is likely to be in each group and how that group's characteristics differ from other groups.



- **Fit**
  - Latent class models
  - Latent profile models
  - Path models with categorical latent variables
  - Multiple-group models with known groups

- **Categorical latent variables measured by**
  - Binary items
  - Ordinal items
  - Continuous items
  - Count items
  - Categorical items
  - Fractional items
  - Even survival items

- **Model-based method of classification**

- **Estimate probabilities, means, and counts for items in each class**

- **Estimate proportion of population in each class**

- **Predict class membership**

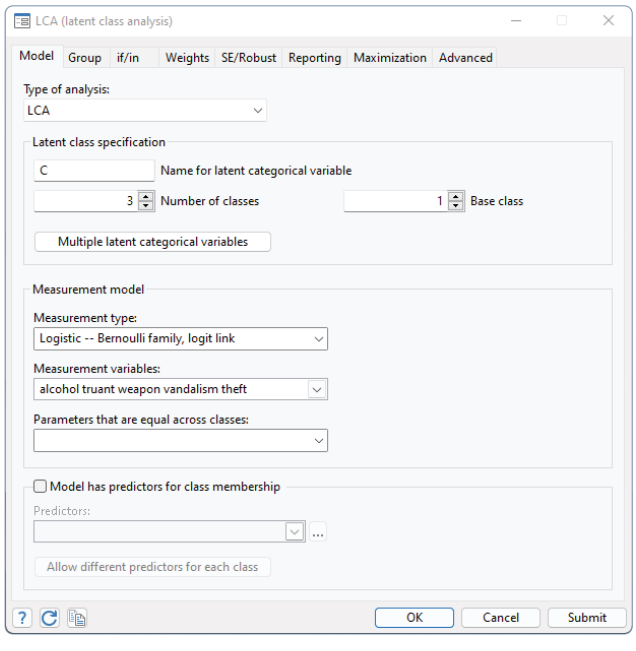
- **Goodness of fit**
  - G^2
  - AIC
  - BIC
  - Entropy New

- **Model-comparison tests**
  - Vuong–Lo–Mendell–Rubin LR test New
  - Lo–Mendell–Rubin-adjusted LR test New

- **Multiple options for obtaining starting values**

- **Support for complex survey data**

- **Point and click to fit any model**



We could fit a latent class model for adolescent behaviors using variables that indicate whether an individual consumed alcohol, was truant from school, used a weapon in a fight, engaged in vandalism, or committed theft. We simply type

```
. gsem (alcohol truant weapon vandalism theft <-),
       logit lclass(C 3)
```

Our model assumes that there are three latent classes—three unobserved groups of adolescents.

Based on the fitted model, we can estimate the proportion of adolescents in the population belonging to each class.

Viewer - view lca1.smcl

```
. estat lcprob

Latent class marginal probabilities                 Number of obs = 10,000
```

	Margin	Delta-method std. err.	[95% conf.	interval]
C				
1	.1631459	.0390464	.1001516	.2545542
2	.7979467	.0389126	.7110459	.8637217
3	.0389074	.0165519	.0167174	.0879179

About 16% of adolescents are expected to be in the first class, 80% in the second, and 4% in the third.

How do these classes differ? **estat lcmean** estimates the mean—in this case, a probability—of the observed variables in each class.

Viewer - view lca2.smcl

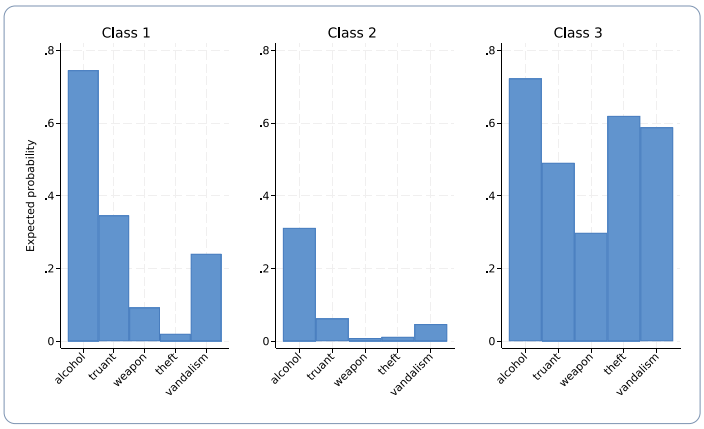
```
. estat lcmean

Latent class marginal means                         Number of obs = 10,000
```

	Margin	Delta-method std. err.	[95% conf.	interval]
1				
alcohol	.7453054	.055844	.6217857	.8389347
truant	.3461541	.0511504	.2537076	.4518892
weapon	.0928717	.0273733	.0513735	.162161
theft	.0207514	.0341545	.0007855	.3635619
vandalism	.2407638	.0519997	.1536777	.3564169
2				
alcohol	.3120356	.0150696	.2832886	.3423065
truant	.0626883	.0076641	.0492432	.0794975
weapon	.0089407	.0023358	.0053525	.0148983
theft	.0123995	.002113	.0088731	.0173028
vandalism	.0471581	.005303	.0377877	.0587103
3				
alcohol	.7227077	.0346378	.6500293	.7852786
truant	.4910226	.0426644	.4084192	.5741192
weapon	.2985074	.0498658	.2106265	.4042764
theft	.6199426	.1870201	.2560825	.8854454
vandalism	.5883387	.0735654	.4407243	.7216029

Probabilities of drinking alcohol, being truant, etc., are the lowest for individuals in the second class. The third class has higher probabilities of engaging in each of these behaviors.

We can use **margins** and **marginsplot** to visually compare the probabilities of participating in these activities across classes.



Did our model fit well?

Viewer - view lca3.smcl

```
. estat lcgof
```

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(14)	6.590	model vs. saturated
p > chi2	0.949	
Information criteria		
AIC	32510.523	Akaike's information criterion
BIC	32633.099	Bayesian information criterion

The likelihood-ratio test indicates that our model has reasonable fit. To compare this model with models having different numbers of classes, we could use lcstats.

We are not limited to this basic latent class model.

Want to use continuous instead of binary observed variables?

```
. gsem (y1 y2 y3 y4 y5 <-), regress lclass(C 3)
```

Or use ordinal observed variables?

```
. gsem (y1 y2 y3 y4 y5 <-), ologit lclass(C 3)
```

Or even mix types of observed variables?

```
. gsem (y1 <-, regress)
       (y2 <-, poisson)
       (y3 <-, logit)
       (y4 <-, logit)
       (y5 <-, ologit),
       lclass(C 3)
```

Want to include a predictor of class membership?

```
. gsem (y1 y2 y3 y4 y5 <-) (C <- income),
       logit lclass(C 3)
```

Want to fit a path model with class-specific parameter estimates?

```
. gsem (y1 <- y2 x1 x2)
       (y2 <- y3 x1 x3)
       (y3 <- x2 x3 x4),
       lclass(C 3)
```

You can do all of this and much more.