**New in Bayes: Multiple chains, predictions, & more**

- Multiple chains
- Gelman–Rubin convergence diagnostics
- Bayesian predictions
- Posterior summaries of simulated values
- MCMC replicates
- Posterior predictive p-values

**Multiple chains**

Use new option `nchains()` with `bayes:` or `bayesmh` to simulate multiple chains.

Fit regression of `y` on covariates `x1` through `x10` and generate 3 chains.

Check Gelman–Rubin convergence diagnostics.

Explore convergence visually for coefficient of `x6`.

```plaintext
use new_chains.mtc
.bayesstats grubin, sort
gelman-rubin convergence diagnostic
number of chains = 3
F(WR) size, per chain = 10,000
max gelman-rubin wr = 4.960385

x6: 4.502325
x7: 3.276406
x10: 3.185673
x9: 3.040546
x5: 2.585164
x7: 2.467039
x6: 3.713081
x2: 2.400129
x8: 3.586034
x1: 1.690013
x0: 1.035478

Stats: 1.023943

Convergence rule: Rc < 1.1
```

```plaintext
.bayesgraph diagnostics (y:x6)
```
Bayesian predictions

- Predict new values
- Check model fit using posterior predictive checks
- Compute functions of predicted values
- Specify your own prediction functions
- Obtain posterior summaries of predicted values
- Generate MCMC replicates
- Compute posterior predictive $p$-values

Bayesian predictions are outcome values simulated from the posterior predictive distribution. They are useful for predicting new outcome values and for checking model fit. Let's use `bayesmh` to fit a general Bayesian model:

```
. bayesmh y
... likelihood(...) prior(...)
```

### Posterior summaries of predictions

Compute posterior mean and credible intervals for all observations, and store them in variables `pmean`, `cril`, and `criu`:

```
. bayespredict pmean, mean
. bayespredict cri criu, cri
```

### MCMC replicates

Compute 6 MCMC replicates, and store them in variables `yrep1`, `yrep2`, and so on:

```
. bayesreps yrep*, nreps(6)
```

### List the first 10 observations

```
. list yrep* in 1/10
```

### Posterior predictive $p$-values

Simulate predictions for outcome `y`, and save them in `y_pred.dta`:

```
. bayespredict (_ysim), saving(y_pred)
```

Compute posterior predictive $p$-values; use Mata's built-in functions and your own.

```
. mata: {
    real scalar mkbcdf(real scalar x) {return/applength(x)*sum(x-mk(x,x)-3)^2)}/3.5)
}
```

### Perform analyses using GUI

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