Untitled

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```
library(cmdstanr)
```

```
## This is cmdstanr version 0.5.3
## - CmdStanR documentation and vignettes: mc-stan.org/cmdstanr
## - CmdStan path: C:/Users/antti/Documents/.cmdstan/cmdstan-2.31.0
## - CmdStan version: 2.31.0
```

```
library(Stat2Data)
data("FirstYearGPA")
```

Data

```
male_white <- FirstYearGPA[FirstYearGPA$Male==1 & FirstYearGPA$White==1,]
male_non_white <- FirstYearGPA[FirstYearGPA$Male==1 & FirstYearGPA$White==0,]
female_white <- FirstYearGPA[FirstYearGPA$Male==0 & FirstYearGPA$White==1,]
female_non_white <- FirstYearGPA[FirstYearGPA$Male==0 & FirstYearGPA$White==0,]
```

```
data_hierarchical <- list(c())
```

Model

```
writeLines(readLines("hierarchical.stan"))
```

```
## // Hierarchical model.
## // Betas in following order: HSGPA, SATM, SATV, HU, SS
## // Alpha: GPA
## data {
##   int<lower=0> N1;
##   int<lower=0> N2;
##   matrix[N1,5] d1;
##   matrix[N2,5] d2;
##
##   vector[5] hypermu;
##   vector[5] hypers;
##   real pssigma;
## }
##
## parameters {
##   // parameters
##   real alpha1;
```

```
##   real alpha2;
##   vector[5] betas1;
##   vector[5] betas2;
##   real<lower=0> sigma;
##
##   // hyperparameters
##   real pmualpha;
##   real psalpha;
##   vector[5] pmubetas;
##   vector[5] psbetas;
## }
##
## transformed parameters {
##   vector[N1] mu1;
##   vector[N2] mu2;
##   mu1 += alpha1;
##   for (i in 1:5)
##     mu1 += betas1[i]*d1[,i];
##   mu2 += alpha2;
##   for (i in 1:5)
##     mu2 += betas2[i]*d2[,i];
## }
##
## model {
##   // hyperpriors
##   pmualpha ~ normal(hypermu, hypers);
##   psalpha ~ normal(hypermu, hypers);
##   pmubetas ~ normal(hypermu, hypers); // The parameters here should be vectors so that each slope be
##   psbetas ~ normal(hypermu, hypers); // Here as well
##
##   // priors
##   alpha1 ~ normal(pmualpha, psalpha);
##   alpha2 ~ normal(pmualpha, psalpha);
##   betas1 ~ normal(pmubetas, psbetas);
##   betas2 ~ normal(pmubetas, psbetas);
##   sigma ~ normal(0, pssigma);
##
##   // likelihoods
##   d1[,1] ~ normal(mu1, sigma);
##   d2[,1] ~ normal(mu2, sigma);
## }
```

```
writeLines(readLines("pooled.stan"))
```

```
## // Pooled model.
## // Variables: HSGPA, SATM, SATV, HU, SS
## data {
##   int<lower=0> N;
##   matrix[N,5] d;
##
##   real pmualpha;
##   real psalpha;
##   vector[5] pmubetas;
##   vector[5] psbetas;
##   real pssigma;
```

```
## }
##
## parameters {
##   real alpha;
##   vector[5] betas;
##   real<lower=0> sigma;
## }
##
## transformed parameters {
##   vector[N] mu;
##   mu += alpha;
##   for (i in 1:5)
##     mu += betas[i]*d[,i];
## }
##
## model {
##   // priors
##   alpha ~ normal(pmualpha, psalpha);
##   betas ~ normal(pmubetas, psbetas);
##   sigma ~ normal(0, pssigma);
##
##   // likelihood
##   d[,1] ~ normal(mu, sigma);
## }
```

```
mod_pooled <- cmdstan_model("pooled.stan")
mod_hierarchical <- cmdstan_model("hierarchical.stan")
```