Example of fitting the marginal logistic model via Prentice GEE with an exponential decay structure

```
# Source the R functions needed
source('FUNCTIONS.R')

# Design
I <- 20         # number of clusters
n <- 30         # number of participants per cluster per period
T <- 5          # number of time periods
q <- I/(T-1)    # number of clusters randomized at each step
sig <- 0.05     # significance level
p0 <- 0.3       # baseline prevalence under control
beta <- c(log(p0/(1-p0)),-0.87,-0.89,-0.91,-0.93) # gently decreasing time-effect
theta <- 0.4592 # intervention effect on the log odds ratio scale
tau <- 0.06     # within-period correlation
rho <- 0.7715   # decay parameter
times <- 1:T
varrho <- rho^abs(outer(times,times,"-"))
R <- (1-tau)*diag(n*T) + kronecker(tau*varrho,matrix(1,nrow=n,ncol=n)) # exponential decay correlation
invR <- solve(R)  # inverse of the exponential decay correlation matrix
trtSeq <- matrix(0,T-1,T)
trtSeq[upper.tri(trtSeq)] <- 1  # treatment sequences
Z_part <- kronecker(diag(T),rep(1,n)) # the time part of the design matrix

# Simulate data
set.seed(218469)
X <- NULL    # Create X matrix for covariates in FITEXPDECAY
for(i in 1:(T-1)){
  for(d in 1:q){
    X <- rbind(X,kronecker(cbind(diag(T),trtSeq[i,]),rep(1,n)))
  }
}
clsize <- rep(n*T,I) # cluster sizes (across all the periods)
clpersize <- clsize/T # cluster-period sizes
B <- create.B(I,T,q,beta,theta,trtSeq,n,R) # Create b's as in Qaqish equation 3
y <- create.response(I,T,q,beta,theta,trtSeq,n,B) # Simulate binary outcomes (Qaqish equation 3)

# Fit the model
fit <- FITEXPDECAY(y=y, X=X, clsize=clsize, clpersize=clpersize, T=T, maxiter=100, epsilon=0.0001)
```

```
## Loading required package: MASS
```

```
fit
```

```
## $coefficients
##      beta estimates model-based SE   sand SE     MD SE
## time     -0.7681669      0.1490626 0.1549107 0.1630479
## time     -0.9096778      0.1577866 0.1558924 0.1663390
## time     -1.1136748      0.1766121 0.1744434 0.1871090
## time     -0.9131875      0.1900601 0.1586136 0.1713237
## time     -0.8014746      0.2106929 0.2017302 0.2176271
## trt       0.4583487      0.1502908 0.1370804 0.1524039
##
## $corr_parameters
```

```
##     alpha estimates
## tau      0.06503735
## rho      0.92004712
##
## $model_fit
##          model converged     number of iterations corr parameters in range
##                    "TRUE"                       "6"                    "TRUE"
```