Untitled

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```
library(igraph)
```

```
##
## Attaching package: 'igraph'
```

```
## The following objects are masked from 'package:stats':
##
##     decompose, spectrum
```

```
## The following object is masked from 'package:base':
##
##     union
```

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:igraph':
##
##     as_data_frame, groups, union
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(StartNetwork)

n <- 500
ni <- 1000

# Erdos - Renyi "gnp"

p <- runif(ni, min = 1e-3, 1e-2)
gnp_df <- cbind(p, t(sapply(p, netw_ss_sim, n = n))) %>% as.data.frame()
gnp_lm <- lm(formula = p ~ edges + twostar + threestar + triangles + poisson_est, data = gnp_df)
summary(gnp_lm)
```

```
##
## Call:
## lm(formula = p ~ edges + twostar + threestar + triangles + poisson_est,
##     data = gnp_df)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -6.112e-04 -1.297e-04 -1.220e-06  1.117e-04  6.423e-04
##
```

```
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.327e-04  1.252e-04  -1.060    0.289
## edges        1.009e+00  1.173e-02  86.074   <2e-16 ***
## twostar      3.399e-05  2.061e-04   0.165    0.869
## threestar    2.094e-04  2.384e-04   0.878    0.380
## triangles   -2.041e-03  1.385e-03  -1.474    0.141
## poisson_est  1.161e-06  1.015e-06   1.143    0.253
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0002087 on 994 degrees of freedom
## Multiple R-squared:  0.9939, Adjusted R-squared:  0.9939
## F-statistic: 3.233e+04 on 5 and 994 DF,  p-value: < 2.2e-16
```

```
# gnp_gam <- mgcv::gam(formula = p ~ s(edges) + s(twostar) + s(threestar) + s(triangles) + s(poisson_es
# summary(gnp_gam)

# Barabasi - Albert "pa"

power <- runif(ni, min = 0.8, 1.2)
pa_df <- cbind(power, t(sapply(power, netw_ss_sim, n = n, type = "pa"))) %>% as.data.frame()
pa_lm <- lm(formula = power ~ edges + twostar + threestar + triangles + poisson_est, data = pa_df)
summary(pa_lm)
```

```
##
## Call:
## lm(formula = power ~ edges + twostar + threestar + triangles +
##     poisson_est, data = pa_df)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.228786 -0.047633  0.004679  0.048217  0.228254
##
## Coefficients: (1 not defined because of singularities)
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.182e+00  1.578e-01   7.494 1.47e-13 ***
## edges        1.483e+02  4.443e+01   3.338 0.000876 ***
## twostar     -1.793e+00  1.373e-01 -13.054  < 2e-16 ***
## threestar   -2.806e+00  2.047e-01 -13.703  < 2e-16 ***
## triangles           NA         NA      NA       NA
## poisson_est -7.327e-03  3.444e-04 -21.274  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.07422 on 995 degrees of freedom
## Multiple R-squared:  0.578,  Adjusted R-squared:  0.5763
## F-statistic: 340.7 on 4 and 995 DF,  p-value: < 2.2e-16
```

```
# pa_gam <- mgcv::gam(formula = power ~ s(twostar) + s(threestar) + s(poisson_est), data = pa_df)
# summary(pa_gam)

# Stochastic block model "sbm"

block_p <- 10^runif(ni, -2.5, -2)
```

```r
sbm_df <- cbind(block_p, t(sapply(block_p, netw_ss_sim, n = n, type = "sbm"))) %>% as.data.frame()
sbm_lm <- lm(formula = block_p ~ edges + twostar + threestar + triangles + poisson_est, data = sbm_df)
summary(sbm_lm)
```

```
##
## Call:
## lm(formula = block_p ~ edges + twostar + threestar + triangles +
##     poisson_est, data = sbm_df)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -8.881e-04 -2.132e-04 -6.270e-06  1.908e-04  1.156e-03
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -8.661e-04  1.646e-04  -5.261 1.75e-07 ***
## edges        1.914e+00  3.721e-02  51.434  < 2e-16 ***
## twostar     -4.028e-04  3.980e-04  -1.012   0.3118
## threestar    1.201e-03  6.112e-04   1.965   0.0497 *
## triangles   -1.323e-03  4.341e-03  -0.305   0.7606
## poisson_est  1.677e-06  1.413e-06   1.187   0.2356
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.000317 on 994 degrees of freedom
## Multiple R-squared:  0.9741, Adjusted R-squared:  0.974
## F-statistic:  7476 on 5 and 994 DF,  p-value: < 2.2e-16
```

```r
# sbm_gam <- mgcv::gam(formula = block_p ~ s(edges) + s(twostar) + s(threestar) + s(triangles) + s(pois
# summary(sbm_gam)
```

```r
# Small world network

p <- 10^runif(ni, -4, -1)
smallworld_df <- cbind(p, t(sapply(p, netw_ss_sim, n = n, type = "smallworld"))) %>% as.data.frame()
smallworld_lm <- lm(formula = p ~ edges + twostar + threestar + triangles + poisson_est, data = smallwo
summary(smallworld_lm)
```

```
##
## Call:
## lm(formula = p ~ edges + twostar + threestar + triangles + poisson_est,
##     data = smallworld_df)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -0.0078241 -0.0005506  0.0002484  0.0007779  0.0095711
##
## Coefficients: (3 not defined because of singularities)
##               Estimate Std. Error  t value Pr(>|t|)
## (Intercept)  1.939e-01  7.953e-04  243.799  < 2e-16 ***
## edges               NA         NA       NA       NA
## twostar             NA         NA       NA       NA
## threestar           NA         NA       NA       NA
## triangles   -2.071e-02  1.119e-04 -185.025  < 2e-16 ***
## poisson_est  3.007e-04  3.776e-05    7.965  4.5e-15 ***
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.002022 on 997 degrees of freedom
## Multiple R-squared:  0.9922, Adjusted R-squared:  0.9922
## F-statistic: 6.347e+04 on 2 and 997 DF,  p-value: < 2.2e-16
```

```
# smallworld_gam <- mgcv::gam(formula = p ~ s(threestar) + s(triangles) + s(poisson_est), data = smallw
# summary(smallworld_gam)
```