

# Presentation

Quadrant count ratio (QCR):

```
qcr <- function(X, Y) {  
  r_Q <- 0  
  med_x <- median(X)  
  med_y <- median(Y)  
  for (i in 1:length(X)) {  
    r_Q <- r_Q + sign(X[[i]] - med_x) * sign(Y[[i]] - med_y)  
  }  
  r_Q <- r_Q/length(X)  
}
```

```
mu <- c(X = 0, Y = 0)  
rhos <- c(0, 0.5, 0.9)  
sample_size <- c(20, 60, 100)  
for (size in sample_size) {  
  p <- vector("list", length = length(sample_size))  
  for (i in 1:length(rhos)) {  
    K <- matrix(c(1, rhos[i], rhos[i], 1), nrow = 2, ncol = 2)  
    dta <- mvrnorm(n = size, mu = mu, Sigma = K)  
    cap <- paste("$\\rho =", toString(rhos[i]))  
    p[[i]] <- ggplot(data.frame(dta), mapping = aes(x = X, y = Y)) + geom_point(color = "red") +  
      stat_ellipse(color = "darkblue", size = 1.05) + labs(caption = TeX(cap)) +  
      theme(plot.caption = element_text(hjust = 0.5, size = 12))  
  }  
  name <- paste("resources\\ellipse", toString(size), ".pdf", sep = "")  
  ggsave(name, plot_grid(plotlist = p, nrow = 1, ncol = 3), device = "pdf", width = 15)  
}
```

```
## Saving 15 x 4.5 in image  
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```

```
rows_name <- c("$E(z)$", "$E(z^2)$", "$D(z)$")  
number_of_tests <- 1000  
rhos <- c(0, 0.5, 0.9)  
# rhos <- c(0)  
mu <- c(X = 0, Y = 0)  
sample_size <- c(20, 60, 100)  
# sample_size <- c(20)  
for (size in sample_size) {  
  for (rho in rhos) {  
    K <- matrix(c(1, rho, rho, 1), nrow = 2, ncol = 2)  
    pearson_res_mixt = list()  
    spearman_res_mixt = list()  
    qcr_res_mixt = list()  
    for (i in 1:number_of_tests) {  
      dta <- mvrnorm(n = size, mu = mu, Sigma = K)
```

```

        pearson_res_mixt[i] <- cor(dta[1:size], dta[(size + 1):(2 * size)], method = "pearson")
        spearman_res_mixt[i] <- cor(dta[1:size], dta[(size + 1):(2 * size)],
            method = "spearman")
        qcr_res_mixt[i] <- qcr(dta[1:size], dta[(size + 1):(2 * size)])
    }
    pearson_res_mixt <- unlist(pearson_res_mixt)
    spearman_res_mixt <- unlist(spearman_res_mixt)
    qcr_res_mixt <- unlist(qcr_res_mixt)
    Ez <- c(mean(pearson_res_mixt), mean(spearman_res_mixt), mean(qcr_res_mixt))
    Dz <- c(var(pearson_res_mixt), var(spearman_res_mixt), var(qcr_res_mixt))
    Ez2 <- Dz + Ez^2
    Ez <- round(Ez, digits = 3)
    Ez2 <- round(Ez2, digits = 3)
    Dz <- round(Dz, digits = if (rho == 0.9 & size == 100) 4 else 3)
    r <- c(Ez[1], Ez2[1], Dz[1])
    r_s <- c(Ez[2], Ez2[2], Dz[2])
    r_Q <- c(Ez[3], Ez2[3], Dz[3])
    if (rho == 0 & size == 20) {
        Ez <- append(as.list(Ez), rows_name[1], after = 0)
        Ez2 <- append(as.list(Ez2), rows_name[2], after = 0)
        Dz <- append(as.list(Dz), rows_name[3], after = 0)
        Ez[[4]] = paste(toString(Ez[[3]]), "\\\hline ", sep = "")
        Ez2[[4]] = paste(toString(Ez2[[3]]), "\\\hline ", sep = "")
        Dz[[4]] = paste(toString(Dz[[3]]), "\\\hline ", sep = "")
        first_line <- c("$\\rho = 0.0$", "$r$\\eqref{eq::pirs}", "$r_s$\\eqref{eq::spir}",
            "$r_Q$\\eqref{eq::rQ}\\hline ")
        content <- rbind(first_line, Ez, Ez2, Dz)
        write.table(content, file = "resources\\20rho0.tex", sep = "&", col.names = F,
            row.names = F)
    } else {
        content <- data.frame(rows_name, r, r_s, r_Q)
        col_names <- c(paste("$\\rho$ =", toString(rho)), "$r$", "$r_S$", "$r_Q$")
        file_name <- paste("resources\\", toString(size), "rho", toString(rho),
            ".pdf", sep = "")
        knitr::kable(content, format = "latex", col.names = col_names, align = c("l",
            "c", "c", "c"), escape = F) %>% column_spec(1, border_left = T) %>%
            column_spec(4, border_right = T) %>% save_kable(file_name)
    }
}
}

```

```

rows_name <- c("$E(z)$", "$E(z^2)$", "$D(z)$")
number_of_tests <- 1000
probs <- c(0.9, 0.1)
sample_size <- c(20, 60, 100)
for (size in sample_size) {
    pearson_res_mixt = list()
    spearman_res_mixt = list()
    qcr_res_mixt = list()
    K1 <- matrix(c(1, 0.9, 0.9, 1), nrow = 2, ncol = 2)
    mu <- c(X = 0, Y = 0)
    K2 <- matrix(c(100, -90, -90, 100), nrow = 2, ncol = 2)
    for (i in 1:number_of_tests) {
        n1 <- rbinom(1, size = size, prob = probs[1])
    }
}

```

```

n2 <- size - n1
dta1 <- if (n1 == 0)
  NULL else mvrnorm(n = n1, mu = mu, Sigma = K1)
dta2 <- if (n2 == 0)
  NULL else mvrnorm(n = n2, mu = mu, Sigma = K2)
dta <- rbind(dta1, dta2)
pearson_res_mixt[i] <- cor(dta[1:size], dta[(size + 1):(2 * size)], method = "pearson")
spearman_res_mixt[i] <- cor(dta[1:size], dta[(size + 1):(2 * size)], method = "spearman")
qcr_res_mixt[i] <- qcr(dta[1:size], dta[(size + 1):(2 * size)])
}
pearson_res_mixt <- unlist(pearson_res_mixt)
spearman_res_mixt <- unlist(spearman_res_mixt)
qcr_res_mixt <- unlist(qcr_res_mixt)
Ez <- c(mean(pearson_res_mixt), mean(spearman_res_mixt), mean(qcr_res_mixt))
Dz <- c(var(pearson_res_mixt), var(spearman_res_mixt), var(qcr_res_mixt))
Ez2 <- Dz + Ez^2
Ez <- round(Ez, digits = 3)
Ez2 <- round(Ez2, digits = 3)
Dz <- round(Dz, digits = 3)
r <- c(Ez[1], Ez2[1], Dz[1])
r_s <- c(Ez[2], Ez2[2], Dz[2])
r_Q <- c(Ez[3], Ez2[3], Dz[3])
content <- data.frame(rows_name, r, r_s, r_Q)
col_names <- c(paste("$n$ =", toString(size)), "$r$", "$r_S$", "$r_Q$")
file_name <- paste("resources\\", "mixedDistr", toString(size), ".pdf", sep = "")
knitr::kable(content, format = "latex", col.names = col_names, align = c("l",
  "c", "c", "c"), escape = F) %>% column_spec(1, border_left = T) %>% column_spec(4,
  border_right = T) %>% save_kable(file_name)
}

```