Paul Kogan-Midterm1

Paul Kogan

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```
rjct <- function(lvl) paste("<= alpha =", lvl,
    "so reject the null\n\t\t\thypothesis that the")
conc <- function(test, hyp, lvl = 1 - attr(test$conf.int, "conf.level"),
                 f = T) {
    lvl <- ifelse(length(lvl) == 0, 0.05, lvl)
    val <- test$p.value
    str <- paste("conclusion: p-value =", val,
           ifelse(val <= lvl, rjct(lvl), rjct(lvl) %>%
           str_replace_all(c("<=" = ">", "so" = "so fail to"))), hyp)
    if (f) cat(str)
    invisible(str)
}
```

1

```
rand.vec <- rchisq(70, 5)
rand.mat <- matrix(rand.vec, 10, 7, T)
cat("Vector:\n")
rand.vec
cat("\n\tMatrix:\n")
rand.mat
cat("\n\tProduct:\t", prod(rand.mat[, 5]^2), "\n\n")
```

```
## Vector:
##  [1]  3.2558115  3.5458472  2.4577974  1.0212644  5.9128833  3.5690773
##  [7]  4.2119319  3.0715670  0.9365294  6.5931240  5.3668863  2.8214465
## [13]  6.8181772  4.3932624  5.2706012  4.2536464  4.8798255  3.3595290
## [19]  6.4776482  6.5763563  4.2202476  4.9422278  0.8525529  7.1515643
## [25]  5.6195806  1.1169683  1.4759376  4.9038647  3.4330379 11.5841264
## [31]  1.5674149  3.3780372  2.3441819  8.1619107  1.9151193  7.8566753
## [37]  4.1481189  4.4401334 11.6013121  4.7711784  5.8823504  4.8711908
## [43]  1.9517266  6.3852024  2.4978704  2.7860956  4.9497345  4.4906361
## [49]  5.4804929  5.2298014  1.8575168  5.7470233  5.1313613  2.0485607
## [55]  3.4766501  5.4068045 14.2239885  3.0495885  6.5746272 12.4725062
## [61]  8.3164421  8.0499196  2.3303786  3.5285202  4.2656488  4.5222466
## [67]  2.9972781  4.2317629  1.6409613  3.3823603
##
##  Matrix:
##           [,1]       [,2]     [,3]      [,4]     [,5]     [,6]     [,7]
##  [1,]  3.255811  3.5458472 2.457797  1.021264 5.912883 3.569077 4.211932
##  [2,]  3.071567  0.9365294 6.593124  5.366886 2.821446 6.818177 4.393262
```

```
##  [3,]  5.270601  4.2536464 4.879825  3.359529 6.477648 6.576356 4.220248
##  [4,]  4.942228  0.8525529 7.151564  5.619581 1.116968 1.475938 4.903865
##  [5,]  3.433038 11.5841264 1.567415  3.378037 2.344182 8.161911 1.915119
##  [6,]  7.856675  4.1481189 4.440133 11.601312 4.771178 5.882350 4.871191
##  [7,]  1.951727  6.3852024 2.497870  2.786096 4.949734 4.490636 5.480493
##  [8,]  5.229801  1.8575168 5.747023  5.131361 2.048561 3.476650 5.406804
##  [9,] 14.223989  3.0495885 6.574627 12.472506 8.316442 8.049920 2.330379
## [10,]  3.528520  4.2656488 4.522247  2.997278 4.231763 1.640961 3.382360
##
##  Product:     232098233360
```

2

```
prb <- c(.1, 0.3, 0.35, 0.25)
len <- length(prb)
rnd <- random::randomNumbers(1, len, 20, 1)
amt <- as.integer(rnd / len)
cat("1)\n", sample(sample(rnd, len), rnd, T, prb),
    "\n2)\n", rmultinom(amt, rnd, prb))
```

```
## 1)
##  9 10 9 4 4 4 9 8 10 4 4
## 2)
##  2 4 2 3 2 3 5 1
```

3

```
cat("1)\t", pchisq(11, 9),
    "\n2)\t", dpois(7, 2),
    "\n3)\t", pnorm(14, 12, 6, F),
    "\n4)\t", pexp(5, .2) - pexp(2, .2),
    "\n5)\t", dbinom(5, 12, .6), "\n\n")
```

```
## 1)    0.7242911
## 2)    0.003437087
## 3)    0.3694413
## 4)    0.3024406
## 5)    0.1009024
```

4

```
volume <- ISwR::lung$volume
s_vol <- shapiro.test(volume)
t_vol <- t.test(volume, mu = 3.5, alternative = "less")
cat("1)\n")
s_vol
conc(s_vol, "data are normal\n\n")
cat("2)\n")
t_vol
conc(t_vol, "mean of 'volume' is less than 3.5\n\n")
```

```
## 1)
##
##  Shapiro-Wilk normality test
##
## data:  volume
## W = 0.94197, p-value = 0.3131
##
## conclusion: p-value = 0.313110262729229 > alpha = 0.05 so fail to reject the null
##          hypothesis that the data are normal
##
## 2)
##
##  One Sample t-test
##
## data:  volume
## t = -2.3529, df = 17, p-value = 0.01547
## alternative hypothesis: true mean is less than 3.5
## 95 percent confidence interval:
##      -Inf 3.429046
## sample estimates:
## mean of x
##  3.227778
##
## conclusion: p-value = 0.0154653914689957 <= alpha = 0.05 so reject the null
##          hypothesis that the mean of 'volume' is less than 3.5
```

5

```
lvl <- .1
after <- c(49, 60, 65, 52, 58, 67)
before <- c(75, 82, 79, 65, 77, 83)
t_bp <- t.test(before, after, paired = T, var.equal =
               var.test(before, after)$p.value > lvl)
t_bp
conc(t_bp, "new drug can decrease the blood pressure of patients")
```

```
##
##  Paired t-test
##
## data:  before and after
## t = 8.9695, df = 5, p-value = 0.0002873
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  13.07916 23.58750
## sample estimates:
## mean of the differences
##                18.33333
##
## conclusion: p-value = 0.000287272901390774 <= alpha = 0.05 so reject the null
##          hypothesis that the new drug can decrease the blood pressure of patients
```