

# Problem Solving Set 1

Sven Bergmann

January 24, 2024

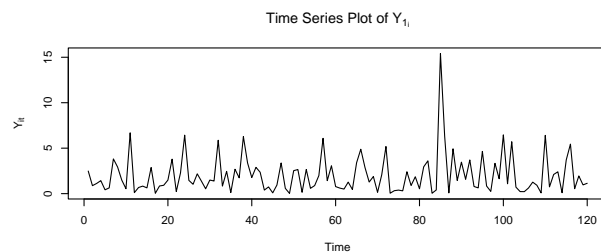
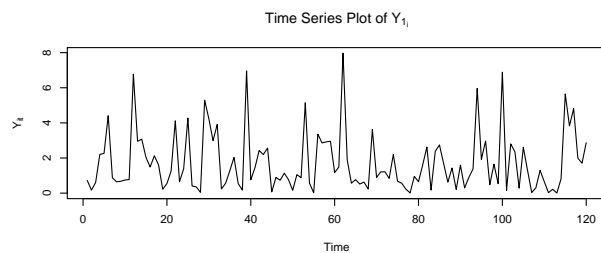
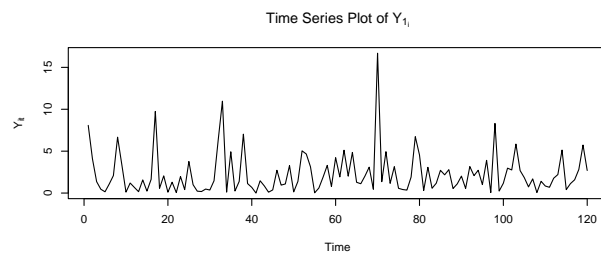
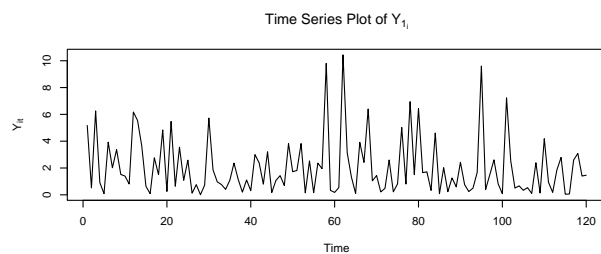
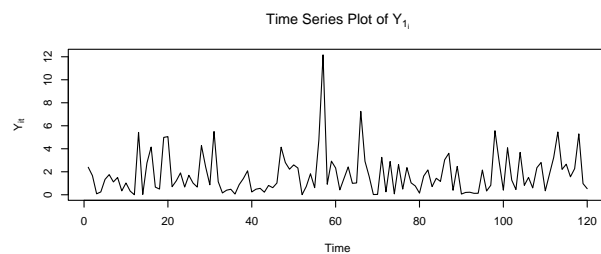
```
set.seed(1401)
```

## Part 1

```
n <- 120
```

```
series_list <- replicate(5, as.ts(rchisq(n, 2, ncp = 0)))
```

```
par(mfrow = c(3, 2))
for (i in 1:5) {
  plot(series_list[, i], type = "l", xlab = expression("Time"),
        ylab = expression(paste("Y"[i][t])), main = expression(paste("Time Series Plot of Y"[1[i]))))
}
```



$Y_1$

- spikes between 50 and 70
- centered around 2
- no patterns / random scatter

$Y_2$

- more variation than  $Y_1$
- still centered at 2
- no patterns

$Y_3$

- similar to  $Y_1$
- spike at 70

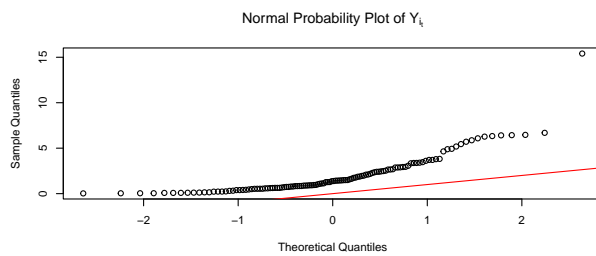
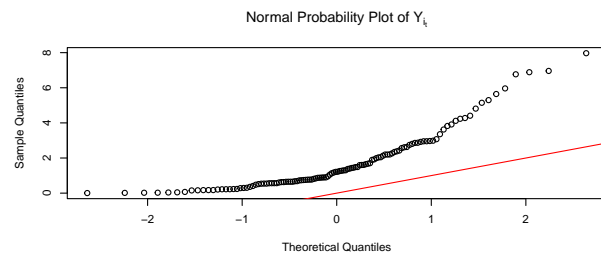
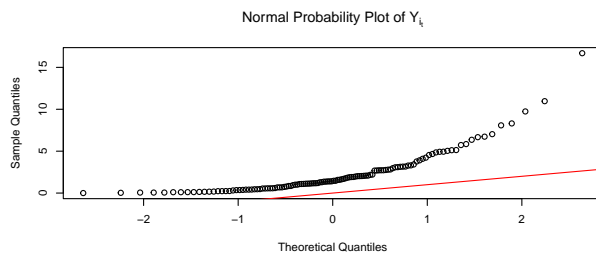
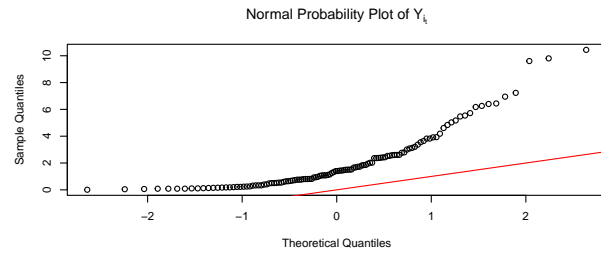
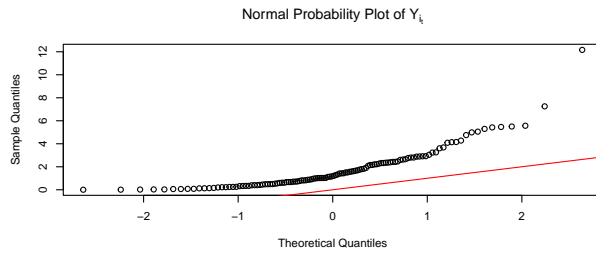
$Y_4$

- centered at 2
- spike near 60
- random scatter

$Y_5$

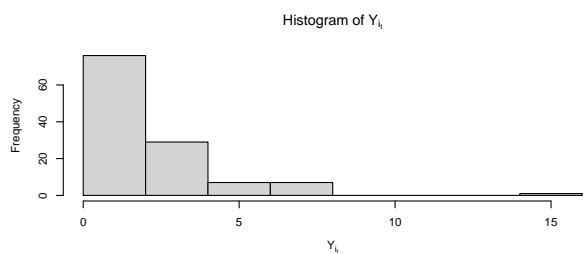
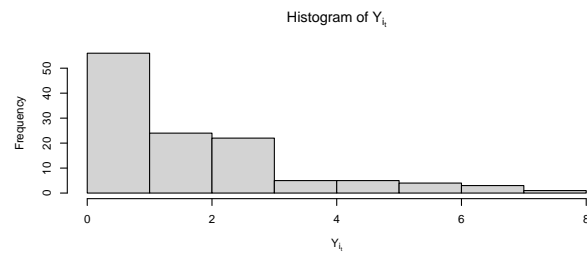
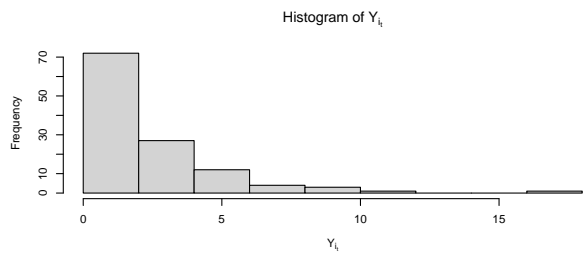
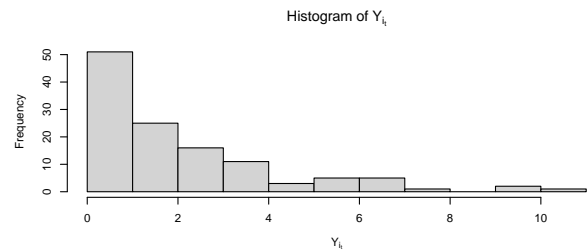
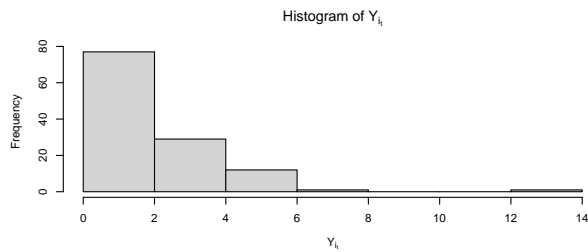
- similar to  $Y_1, Y_3$
- spike at / around 90

```
par(mfrow = c(3, 2))
for (i in 1:5) {
  qqnorm(series_list[, i], main = expression(paste("Normal Probability Plot of Y"[i[t]])))
  abline(a = 0, b = 1, col = "red")
}
```



- not linear,
- heavy right tail -> skewed right

```
par(mfrow = c(3, 2))
for (i in 1:5) {
  hist(series_list[, i], xlab = expression(paste("Y"[i[t]])),
        main = expression(paste("Histogram of Y"[i[t]])))
}
```



## Part 2

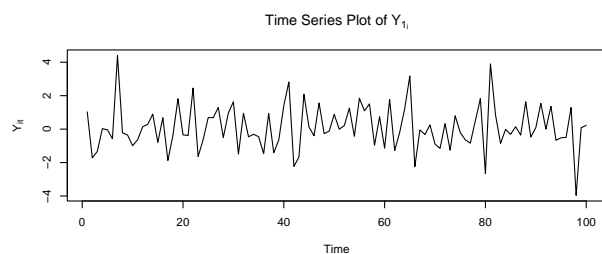
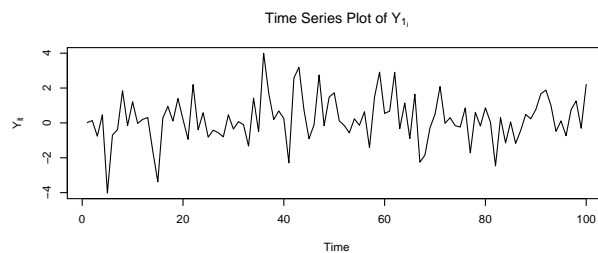
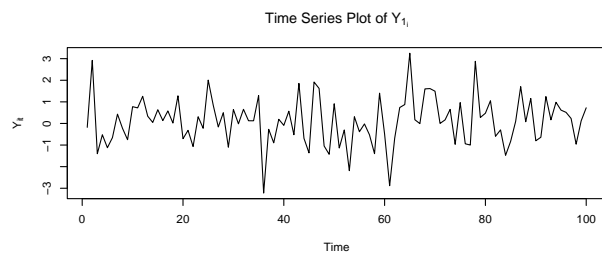
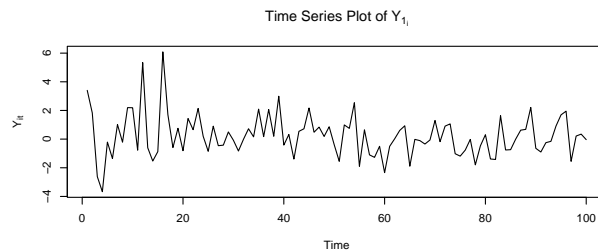
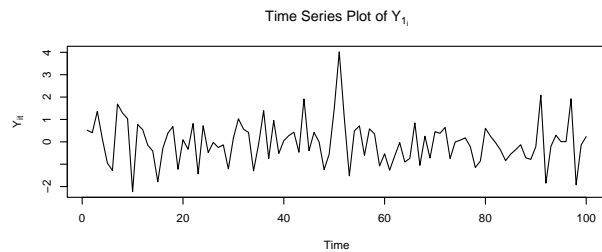
### Expectations

- properties of a t-dist.
- look somewhat normal
- unimodal
- symmetric
- centered about 0
- random scatter / no patterns - property of random sample

```
n <- 100
```

```
series_list <- replicate(5, as.ts(rt(n, 5, ncp = 0)))
```

```
par(mfrow = c(3, 2))
for (i in 1:5) {
  plot(series_list[, i], type = "l", xlab = expression("Time"),
        ylab = expression(paste("Y"[i][t])), main = expression(paste("Time Series Plot of Y"[1[i]))))
}
```



$Y_1$

- centered at 0
- spike at 50
- random scatter / no patterns

$Y_2$

- signs of uneven spread
- suggests nonstationary series
- centered at 0
- no patterns

$Y_3$

- centered at 0
- random scatter
- fairly even spread

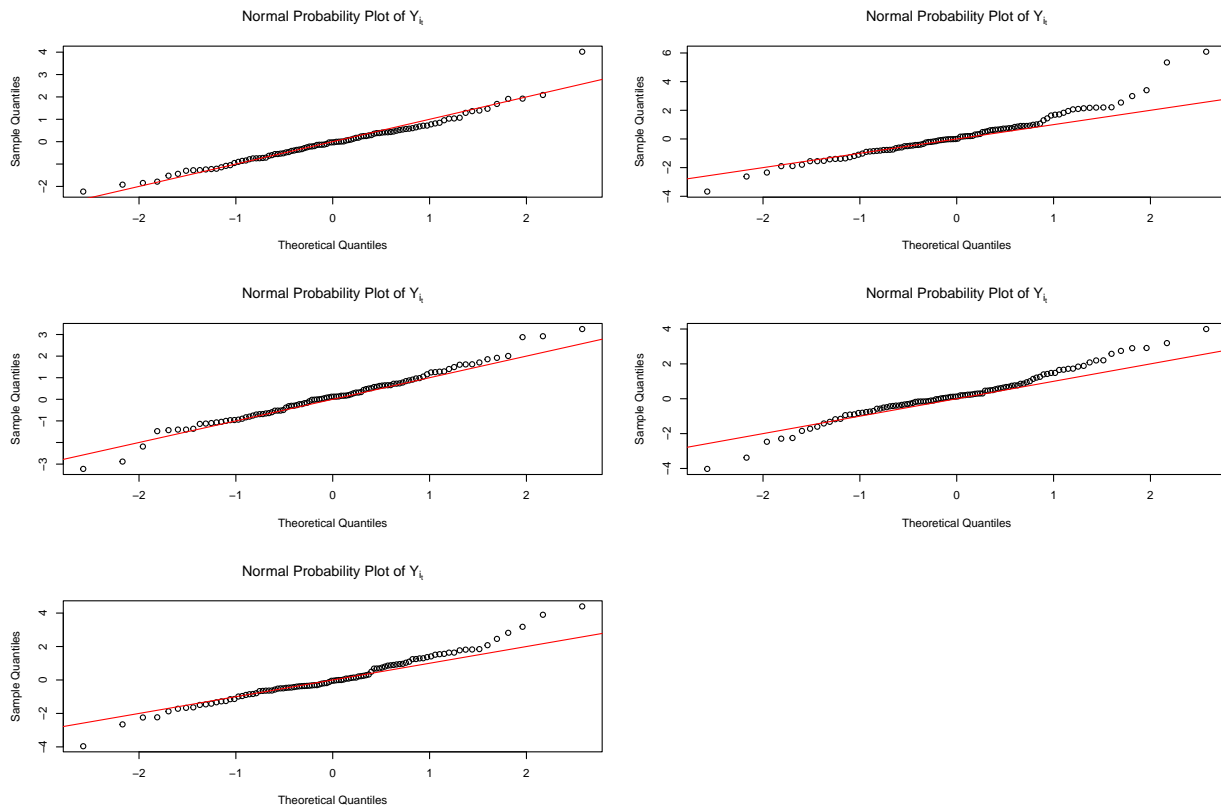
$Y_4$

- centered at 0
- possible periodic pattern
- fairly even spread

$Y_5$

- centered at 0
- random scatter
- fairly even spread

```
par(mfrow = c(3, 2))
for (i in 1:5) {
  qqnorm(series_list[, i], main = expression(paste("Normal Probability Plot of Y"[i[t]])))
  abline(a = 0, b = 1, col = "red")
}
```



$Y_1$

- heavy right tail
- left side - tail resembles that of a normal distribution

$Y_2$

- two heavy tails
- middle looks really normal

$Y_3$

- heavy tails

- middle looks okay
- lighter than tails of  $Y_2$

$Y_4$

- both tails are heavy
- middle is linear

$Y_5$

- similar to  $Y_4$

```
par(mfrow = c(3, 2))
for (i in 1:5) {
  hist(series_list[, i], xlab = expression(paste("Y"[i[t]])),
       main = expression(paste("Histogram of Y"[i[t]])))
}
```

