Bayes Methods

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library(tidyverse)
library(readxl)

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Comasco2015 = tibble::tibble(
  "Week" = c(1, 2, 3, 4, 5, 6, 1, 2, 3, 4, 5, 6, 1, 2, 3, 4, 5, 6),
  "Group" = c("AFR", "AFR", "AFR", "AFR", "AFR", "AFR", "MS15", "MS15", "MS15", "MS15", "MS15
  "Ethanol_Percentage" = c(5, 5, 20, 20, 20, 20, 5, 5, 20, 20, 20, 20, 5, 5, 20, 20, 20, 20)
  "Access_Hours" = c(24, 2, 2, 2, 2, 2, 24, 2, 2, 2, 2, 2, 24, 2, 2, 2, 2, 2),
  "Median" = c(1.61, 0.40, 1.10, 1.21, 1.37, 1.18, 1.89, 0.67, 1.12, 1.49, 1.23, 1.32, 1.53,
  "a" = c(0.29, 0.18, 0.50, 0.59, 0.77, 0.62, 0.87, 0.32, 0.75, 0.89, 1.05, 0.39, 0.21, 0.09
  "b" = c(4.16, 0.75, 2.11, 1.42, 2.08, 1.66, 3.40, 0.99, 1.61, 2.13, 1.74, 1.77, 3.28, 1.14
  "n" = c(11, 11, 11, 11, 11, 11, 10, 10, 10, 10, 10, 10, 20, 20, 20, 20, 20, 20),
  "Sessions" = c(3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3))
Comasco2015 = Comasco2015 |>
  mutate(
    Estimated_Mean = (a+2*Median+b)/(4),
    Estimated_SD = ((b - a)/(2 * qnorm((n-0.375)/(n+0.25)))),
    Estimated_Variance = (Estimated_SD)^2
  )

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GN2006 <- read_excel("G&N2006.xlsx")
GN2006 = GN2006 |> group_by(Phase, Group) |> summarise(mean = mean(Ethanol_Intake),
                                                       sd = sd(Ethanol_Intake),
                                                       variance = var(Ethanol_Intake))

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P2003 <- read_excel("P2003.xlsx")
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Sessions = tibble::tibble(Ethanol_Percentage = c(2, 4, 6, 8),
               Sessions = c(4, 4, 7, 11),
               n = c(8, 8, 8, 8))

P2003 = left_join(P2003, Sessions, by = "Ethanol_Percentage")

P2003 = P2003 |> mutate(SD = SEM*sqrt(n),
                        variance = SD^2)

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O2011 <- read_excel("O2011.xlsx")
O2011 = O2011 |> pivot_wider(names_from = Summary_Statistics, values_from = Values)

# estimated mean and SD from Wan et al., 2014
O2011 = O2011 |> mutate(
  Estimated_Mean = ((Minimum + 2*IQR1 + 2*Median + 2*IQR3 + Maximum)/8),
  Estimated_SD = (((Maximum - Minimum)/(4*qnorm((n-0.375)/(n+0.25)))) + ((IQR3-IQR1)/(4*qnorm
  Estimated_Variance = (Estimated_SD)^2
)

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G2007 <- read_excel("G2007.xlsx")
G2007 |> group_by(Group, Days) |> summarise(Mean = mean(Mean_Ethanol_Intake),
                                            SD = sd(Mean_Ethanol_Intake),
                                            Variance = var(Mean_Ethanol_Intake))

################################################################

Daoura2011 = tibble::tibble(
  "Group" = c("MS0", "MS0", "MS0", "MS0", "MS0",
              "MS15", "MS15", "MS15", "MS15", "MS15",
              "MS360", "MS360", "MS360", "MS360", "MS360"),
  "Week" = c(1, 2, 3, 4, 5, 1, 2, 3, 4, 5, 1, 2, 3, 4, 5),
  "Median" = c(1.97, 1.71, 2.08, 2.58, 1.74,
               1.64, 1.75, 1.73, 1.84, 1.83,
               1.69, 1.90, 1.62, 2.40, 2.72),
  "IQR" = c(1.14, 2.27, 1.83, 2.35, 1.79,
            1.11, 2.42, 1.59, 1.85, 1.49,
            0.58, 1.63, 2.36, 2.14, 1.67),
  "n" = c(15, 15, 15, 15, 15,
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          15, 15, 15, 15, 15,
          14, 14, 14, 14, 14)
)

Daoura2011 = Daoura2011 |> mutate(
  "IQR1" = Median - (IQR/2),
  "IQR3" = Median + (IQR/2)
)

# C3 method
Daoura2011 |>
  mutate(
    Estimated_Mean = ((IQR1+Median+IQR3)/3),
    Estimated_SD = ((IQR3-IQR1)/(2*qnorm((0.75*n-0.125)/(n+0.25)))),
    Estimated_Variance = Estimated_SD^2
  )

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L2017 <- read_excel("L2017.xlsx")

L2017 |> select(c(1:22)) |>
  pivot_longer(c(5:22), names_to = "Week", values_to = "Amount") |>
  mutate(Sessions = 3,
         Intake_Session = Amount/Sessions) |>
  group_by(Rearing, Supplier, Week) |>
  summarise(mean = mean(Intake_Session),
            sd = sd(Intake_Session))

diff_supplier = L2017 |> select(c(1:22)) |>
  pivot_longer(c(5:22), names_to = "Week", values_to = "Amount") |>
  mutate(Sessions = 3,
         Intake_Session = Amount/Sessions)

dif = lm(Intake_Session ~ Week*Supplier*Rearing, data = diff_supplier)
summary(dif) # no difference between suppliers and intake of ethanol (I can combine these)


L2017 = L2017 |> select(c(1:22)) |>
  pivot_longer(c(5:22), names_to = "Week", values_to = "Amount") |>
  filter(!is.na(Amount)) |>
  mutate(Sessions = 3,
```

```
        Intake_Session = Amount/Sessions) |>
  group_by(Rearing, Week) |>
  summarise(mean = mean(Intake_Session),
            sd = sd(Intake_Session),
            variance = var(Intake_Session))

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$$
\begin{aligned}
y_{it} \sim N(\theta_{it}, \sigma_{it}^2) \quad \alpha_i \sim N(0, 100000) \\
\theta_{it} = \alpha_i + \beta_i \cdot time_{it} \quad \mu \sim N(0, 100000) \\
\beta_i \sim N(\mu, \tau^2) \quad \tau \sim N(0, 100),\ \tau > 0
\end{aligned}
$$

y_{it} = observed effect at time-point t in study i
σ_{it}^2 = is the variance of y_{it}
θ_{it} = is the true effect at time point t in study i
α_i *and* β_i = respectively, the intercept and slope for the study-specific linear regression slope
$time_{it}$ = the time-point in study i at time t
μ = overall trend
τ^2 = is the variance in trend between studies

Comasco et al., 2015: weeks 1-5 (increasing)
Daoura et al., 2011: weeks 1-5 (not increasing)
Gustafsson et al., 2007: days 1-18, 19-36, 37-54 (not increasing)
Lundberg et al., 2017: weeks 1-20 (increasing)
Oreland et al., 2011: week 3-7 (increasing)
Ploj et al., 2003: days 4, 4, 7, 11 (not increasing)
Gustafsson & Nylander, 2006: days 1-18, 19-36, 37-54 (not increasing)

Analaysis 1:

Table 1: Groupings for Analysis 1

Article	Time-Point 1	Time-Point 2	Time-Point 3	Time-Point 4	Time-Point 5	Time-Point 6	Time-Point 7
Comasco et al., 2015	week 1	week 2	week 3	week 4	week 5	NA	NA
Daoura et al., 2011	week 1	week 2	week 3	week 4	week 5	NA	NA
Gustafsson et al., 2007	NA	days 1-18	NA	days 19-36	NA	days 37-54	NA
Lundberg et al., 2017	week 1	week 2	week 3	week 4	week 5	week 6	week 7
Oreland et al., 2011	NA	NA	week 3	week 4	week 5	week 6	week 7
Ploj et al., 2003	4 days	4 days	7 days	11 days	NA	NA	NA
Gustafsson & Nylander, 2006	NA	days 1-18	NA	days 19-36	NA	days 37-54	NA

- This analysis groups together both sexes and increasing ethanonl percentage with those that are not increasing.

time-points = {week1, week2, week3, week4, week5, week6, week7, week8}
study i