Exam 1
March 2, 2026

For all problems, you may assume that we have loaded the `alr4` package with `library(alr4)`.

1. (a) For the `wblake` dataset, `pairs(wblake)` and `plot(wblake)` in R
   i. Will give the same plots.
   ii. Will give different plots.

   (b) If we run the codes

   ```
   m1 <- lm(lpres ~ bp, data=Forbes)
   s1 <- summary(m1)
   ```

   which of the following is true about `m1$df` and `s1$df` when you type them in R?
   i. They will give the same number.
   ii. They will give different numbers.
   iii. They cannot be compared, since `m1$df` is not valid.

   (c) For the regression model $y_i = \beta_0 + \beta_1 x_i + e_i$, $i = 1, \ldots, n$, which one of the following is unknown and random
   i. β_1
   ii. e_i
   iii. Both of the above
   iv. None of the above

   (d) For the regression model $y_i = \beta_0 + \beta_1 x_i + e_i$, $i = 1, \ldots, n$, the regression line $\hat{\beta}_0 + \hat{\beta}_1 x$
   i. Must pass through $\bar{x}$ only.
   ii. Must pass through $\bar{y}$ only.
   iii. Must pass through both $\bar{x}$ and $\bar{y}$.
   iv. None of the above.

   (e) If we have an intercept only regression model $y_i = \beta_0 + e_i$, $i = 1, \ldots, n$, then $\hat{\beta}_0$ is
   i. SYY/n
   ii. $\bar{y}$
   iii. Zero (0)
   iv. None of the above, cannot be determined

2. Consider the following R output (abridged and modified) of a simple regression:

```
Call:
lm(formula = y ~ x)

Coefficients:
            Estimate   Std. Error   t value   Pr(>|t|)
(Intercept)   0.8000       0.5846         ?     0.2646
x             0.7600       0.1763     4.312         ??

Residual standard error: 0.5574 on 3 degrees of freedom
Multiple R-squared: 0.8611, Adjusted R-squared: 0.8147
```

   (a) Please write an R code that computes `?` above.

   (b) Please write an R code that computes `??` above.

3. Consider the `ftcollinssnow` datset, with predictor `Early`, and response `Late`.

   (a) Please write an R code that will fit the model $y = \beta_1 x + e$.

   (b) Please provide R codes that will compute se($\hat{\beta}_1$) (not looking at `summary` output).

4. For the regression model $y_i = \beta_0 + \beta_1 x_i + e_i$, $i = 1, \ldots, n$, compute $\sum \hat{e}_i x_i$.