Software setup for model-based estimates of abundance from survey data

1. Install the following programs:

- R 4.5.1 (or 4.4 or higher)
- RStudio recent or latest
- Note: If you need to install any packages from source, you will need a C++ compiler (or the Rtools application on Windows). If you need to install Rtools, follow the steps below.
  - Download: Go to the official CRAN Rtools page.
  - Select the correct version: Choose the Rtools version that is compatible with your installed version of R (e.g., Rtools45 for R 4.5.x, Rtools44 for R 4.4.x, etc.).
  - Run the installer: Execute the downloaded `.exe` file and accept the default installation location (e.g., `C:\rtools45`).
  - Configure R (optional but recommended): The installer usually handles the configuration automatically, but if you encounter issues, you may need to add the Rtools binary path to your system's `PATH` environment variable.

2. In R, install sdmTMB from CRAN

```
install.packages("sdmTMB", dependencies = TRUE)
```

- If asked if you'd like to update any packages, say yes.
- If CRAN asks if you'd like to build a newer package from source, feel free to say no.
- Sometimes some packages fail to install. If any packages fail (e.g. 'non-zero exist status), try installing them separately and then trying to install sdmTMB again.

If you get a warning like this:

```
TMB was built with Matrix version 1.5.3
Current Matrix version is 1.5.1
Please re-install 'TMB' from source using
install.packages('TMB', type = 'source') or ask
CRAN for a binary version of 'TMB' matching CRAN's
'Matrix' package
```

You can safely ignore it (if you want to squash the warning, you can install TMB from source as described).

3. Test to make sure everything is working:

```r
library(sdmTMB)
fit <- sdmTMB(
  density ~ s(depth),
  data = pcod_2011,
  mesh = pcod_mesh_2011,
  family = tweedie(link = "log")
)
fit
```

If successful, you should see this:

```
Spatial model fit by ML ['sdmTMB']
Formula: density ~ s(depth)
Mesh: pcod_mesh_2011 (isotropic covariance)
Data: pcod_2011
Family: tweedie(link = 'log')

Conditional model:
            coef.est coef.se
(Intercept)     2.16    0.34
sdepth          1.94    3.13

Smooth terms:
             Std. Dev.
sd__s(depth)     13.07

Dispersion parameter: 13.68
Tweedie p: 1.58
Matérn range: 16.84
Spatial SD: 2.20
ML criterion at convergence: 2937.789

See ?tidy.sdmTMB to extract these values as a data frame.
```

Again, you can ignore any warnings about Matrix/TMB versions if you see those.

4. Optionally install packages for lecture and exercise on 2/2, including mgcv package for fitting GAMs:

```r
pkgs <- c("dplyr", "ggplot2", "sf","mgcv", "gratia", "visreg", "purrr") #"inlabru"
install.packages(pkgs, dependencies = TRUE,
                 repos = 'http://cran.us.r-project.org')
```