The questions call for computations in `R`, and you will likely want to re-use some of your `R` code from Assignment 1. For this assignment you may call linear-algebra functions in `R` like `chol` and `solve`, and similarly optimization functions like `optim`. But do not use packages written for space-filling designs or Gaussian process modelling; the objective here is to gain some insight into how such packages implement the methods of our course.

1. **Finding experimental designs:** In this question, you are asked to find designs for a computer experiment with two inputs (i.e., $d = 2$) and $n = 20$ trials. Several of the design criteria require difficult optimization, so you can only find "approximately" optimal designs.

   (a) Find a Latin hypercube design for this setting in $[0, 1]^2$. Show a plot of your design.

   (b) Find a minimax design for this setting in $[0, 1]^2$. Report the minimax criterion for your design and also provide a plot of the design points.

   (c) Find a maximin design for this setting in $[0, 1]^2$. Report the maximin criterion for your design and also provide a plot of the design points.

2. **Running a computer experiment:** Using your web browser, navigate to `http://www.sfu.ca/~ssurjano/branin.html`. A computer experiment will be performed using the Branin function with the recommended values for the constants listed on the webpage. Use the original Branin function at the webpage and not the Picheny et al. (2012) modified form. This means you will have to rescale your designs from question 1, which are on $[0, 1]^2$, to the Branin function's actual input ranges.

   (a) Run a computer experiment on the Branin function using the Latin hypercube design in question 1 and emulate the computer model using a GP. Report the estimates for the mean, the correlation parameters and the process variance. Plot the estimated response surface.

   (b) Run a computer experiment on the Branin function using the minimax design in question 1 and emulate the computer model using a GP. Report the estimates for the mean, the correlation parameters and the process variance. Plot the estimated response surface.

   (c) Run a computer experiment on the Branin function using the maximin design in question 1 and emulate the computer model using a GP. Report the estimates for the mean, the correlation parameters and the process variance. Plot the estimated response surface.

3. **Evaluating the computer experiment:** In this question, you are asked to evaluate the fit of the GPs in question 2. To do so, you will need to create a validation set of 100 trials of the Branin function using a Latin hypercube design.

(a) Compute the root mean square prediction error and maximum absolute error for the validation set using the model in question 2(a).

(b) Compute the root mean square prediction error and maximum absolute error for the validation set using the model in question 2(b).

(c) Compute the root mean square prediction error and maximum absolute error for the validation set using the model in question 2(c).