# How to Install Vivado for Macro-Placement Evaluation

We use a special version of Vivado 2021.1 for the MLCAD 2023 Contest to evaluate FPGA macro placements generated by contestants. The instructions of downloading and running the Vivado flow are as follows:

1. **Obtain a Vivado License**
   - Please ask your team's advising professor to obtain a Vivado license from Xilinx's University Program: https://www.xilinx.com/support/university/donation-program.html.

**2. Download the Vivado 2021.1 executable**

After obtaining a Vivado license, please do the following:

- Visit http://www.xilinx.com/support/download (Direct link to 2021.1 is https://www.xilinx.com/support/download/index.html/content/xilinx/en/downloadNav/vivado-design-tools/2021-1.html)
- Sign in using UserID/Password. Create a new account if you do not have one.
- Download **Vivado ML 2021.1**
- Save the executable in some directory, say ***vivado_install_dir***

3. **Download the Vivado 2021.1 MLCAD 2023 Contest Patch**
   - Visit http://www.xilinx.com/getlicense
   - Sign in using UserID/Password. Create a new account if you do not have one.
   - You should see account MLCAD_2023_Contest Release in your drop down menu
   - Click on the **Restricted Downloads** tab
   - You should see the file ***vivado.zip*** patch file
   - Click the download button and download ***vivado.zip***

4. **Install Vivado on a linux machine**

Create a Vivado patch directory (e.g. ***vivado_patch_dir***)

```
% mkdir [path to your vivado_patch_dir]
% cp vivado.zip [ path to your vivado_patch_dir]
% cd [path to your vivado_patch_dir]
% unzip vivado.zip
```

5. **Download Benchmark suite dataset from Kaggle and run Vivado**
   - Download the benchmark design suite from the following Kaggle website:

     https://www.kaggle.com/datasets/ismailbustany/mlcad-2023-fpga-macro-placement-benchmark-suite

   - The public benchmark dataset contains 180 designs (Design_1.tgz, …, Design_180.tgz)

- The benchmark also contains a design specification file, **Design_sepecifications_key**, that lists estimated Vivado place-and-route runtimes for each design as a reference. Observe that designs with the larger clock resources (e.g. 38 clock resources) have the longer runtimes.
- Untar all the files and run Vivado on one of the designs (e.g. Design_1) as follows:

```
% tar xvfz Design*
% cd Design_1
% setenv MYVIVADO [path to your vivado-patch-dir]/vivado
% [path to your vivado_install_dir]/vivado -mode tcl -so place_route.tcl
```

- In case of an illegal placement, Vivado will error out with the illegal placement information.
- If the placement is legal, Vivado router starts and completes routing, or report unroutable design.
- If routing completes successfully, the following message indicates total routed wirelength:

```
Total Routed Wirelength: xxxxx (Vertical xxxx, Horizontal xxxx)
```

- In case of unroutable placement, the following message is issued:

```
CRITICAL WARNING: [Route 35-162] xxxx signals failed to route due
to routing congestion.
```

6. If you encounter any issues, please contact mlcad2023contest@gmail.com