IC-PBL Activity III
(MIMO Detection)

In this project, we will compare the performances of various MIMO detectors in terms of **achievable sum rates** and **symbol error rates**.

IC-PBL Activity: November 18 and November 25

(No face-to-face classes on Nov. 18 and Nov. 25)

Due date: Nov. 25, 17:00

[Simulation Environments]

- The number of transmit antennas is 4.
- The number of receiver antennas is 4.
- Random **4×4 channel matrix** $\mathbf{H} = [h_{ij}]$ where h_{ij} (the (i,j)-th component of $\mathbf{H}$) follows a complex Gaussian distribution with zero-mean and unit variance.

Problem 1. Evaluate the achievable rates

- Plot the average achievable rates, where the average over random channel matrix $\mathbf{H}$ and random additive noise (see the slide 26 in the Lecture note 6).
- In the average, generate 1000 channel matrices for a given SNR. Also, consider the SNR range 0 ~ 20dB (with step 2 dB).
- **Detection Methods:**
  1) Optimal MIMO Detector
  2) Zero-Forcing Detector
  3) MMSE Detector
  4) V-BLAST
- **Submit your source codes, simulation results (figures), and some discussions.**

Problem 2. Evaluate the symbol error rates (SER)

- **QPSK modulation** is assumed (for every antenna)
- Plot the average symbol error rate (SER), where the average over random channel matrix $\mathbf{H}$, random input, and random additive noise
- In the average, generate 1000 channel matrices for a given SNR. Also, consider the SNR range 0 ~ 20dB (with step 2 dB).
- **Detection Methods**
  1) Zero-Forcing Detector
  2) MMSE Detector
- **Submit your source codes, simulation results (figures), and some discussions.**