HW #11 due 5/3/18

1. Design an optical add-drop multiplexer with 5 add-drop wavelengths for a 16 channels WDM system using 2x2 optical switches and Mach-Zehnder filters (similar to the design of HW7 problem 5. Make sure to draw details of the MZ filters) with correct order of wavelength arrangement.

2. a) Consider the 4x4 star coupler in April 24 summary (http://scylla.ceas.uwm.edu/465/summary/pictures/cross_connect.pdf) which has an array of 2x2 switches, i.e. 6 switches. Assume each switch is a 3dB directional coupler (i.e. 3dB coupling loss) and on the top of this there is a 0.3dB insertion loss in connecting a coupler. Find the loss (or degradation of signal) of the 4x4 star coupler. b) We can make a 256x256 star coupler with an array of 128x8 switches. Assume losses for each switch is the same as part a). Find the loss of the 256x256 star coupler.
(Notice: The loss should be considered for each path only. Not the sum of loss for all paths.)

Extra-credit

You can implement an add/drop filter for one wavelength with a circulator, a fiber Bragg grating (FBG) and a directional coupler. It is shown in the Fig. 3.14 (page 128 of the 2nd Ed. of text, page 134 of the 3rd Ed.).

a) Consider the add/drop element in the diagram. The element uses a coupler as a 85%/15% splitter, i.e. 15% of the added signal power crossing over into the output. The FBG induces a loss of 0.5dB for the transmitted signals and no loss for the reflected signal. Assume that the circulator has a loss of 1dB per pass (jump from one port to next one). Carefully compute the loss for a channel that is passed through the device. Suppose the input power per channel is -10 dBm. At what power should the add channel be transmitted so that powers on all the channels at the output are the same? (modified version of problem 3.24 (a) page 230 of the 2nd Ed. text, page 235 of the 3rd Ed.).

b) Design an add/drop filter for 3 wavelengths by extending the current design.