1 Project Title: USB Adapter/Hub

This project aims to mimic the functionality of a USB Adapter commonly used on computers.

2 Technical:

I will design a PCB that mounts my desired peripherals, ideally an Ethernet port, a microSD card port, and another USB port as inputs. Then another USB connector for the output that will be connected to the host device.

The actual design would consist of a few key modules, which I'll describe below:

1. **EthernetToUSB and USBToEthernet Converters**
   - Since these are mirrors of one another, I'll just describe EthernetToUSB
   - As per the name, this module will convert an Ethernet packet into one or more USB packets.
   - It would only support Ethernet 10/100, since Ethernet base 1000 requires 8 pins of input and we are resource constrained

```
module EthToUSB (
  input logic clk,
  input logic rst_n,
  input logic tx_p, tx_n,
  input logic rx_p, rx_n,
  inout logic dp, dn
);
```

2. **SDCardToUSB and USBToSDCard Converters**
   - Same thing as above, only going to describe SDCardToUSB
   - As per the name, this module will convert data from a SD/MicroSD card into one or more USB packets.
   - SD Cards have various operating modes. I would either choose between the one-bit operating mode or the SPI operating mode. For now I'll assume the one-bit operating mode since it only uses 2 pins and can operate faster than SPI.

```
module SDCardToUSB (
  input logic clk,
  input logic rst_n,
  input logic cmd,
  input logic dat0
  inout logic dp, dn
);
```

3. **USB Host**
    - This is essentially building off of what we created in 18341. I'm unsure of the full set of functionality that I would need to add yet, but for now I'll assume that it's the entire protocol as opposed to the few types of packets we implemented in 341.

```
module USBHost (
  input logic clk,
  input logic rst_n,
  inout logic dp, dn
);
```

3 I/Os:

- 4 input pins for Ethernet
- 3 input pins for SD Card
- 2 bidirectional pins for USB
- 2 input pins for VCC + GND? unsure

4 Hardware Peripherals:

As described previously, this would require a PCB to be created that includes an Ethernet, SD Card, USB Device, and USB Host ports.

5 Module Header:

```
module top (
  input  logic clk,
  input  logic rst_n,

  // Ethernet
  input  logic tx_p, tx_n,
  input  logic rx_p, rx_n,

  // SD Card
  output logic cmd,
  input  logic dat0

  // USB
  inout  logic dp, dn
);
```