

# System design

# Project – Grade center

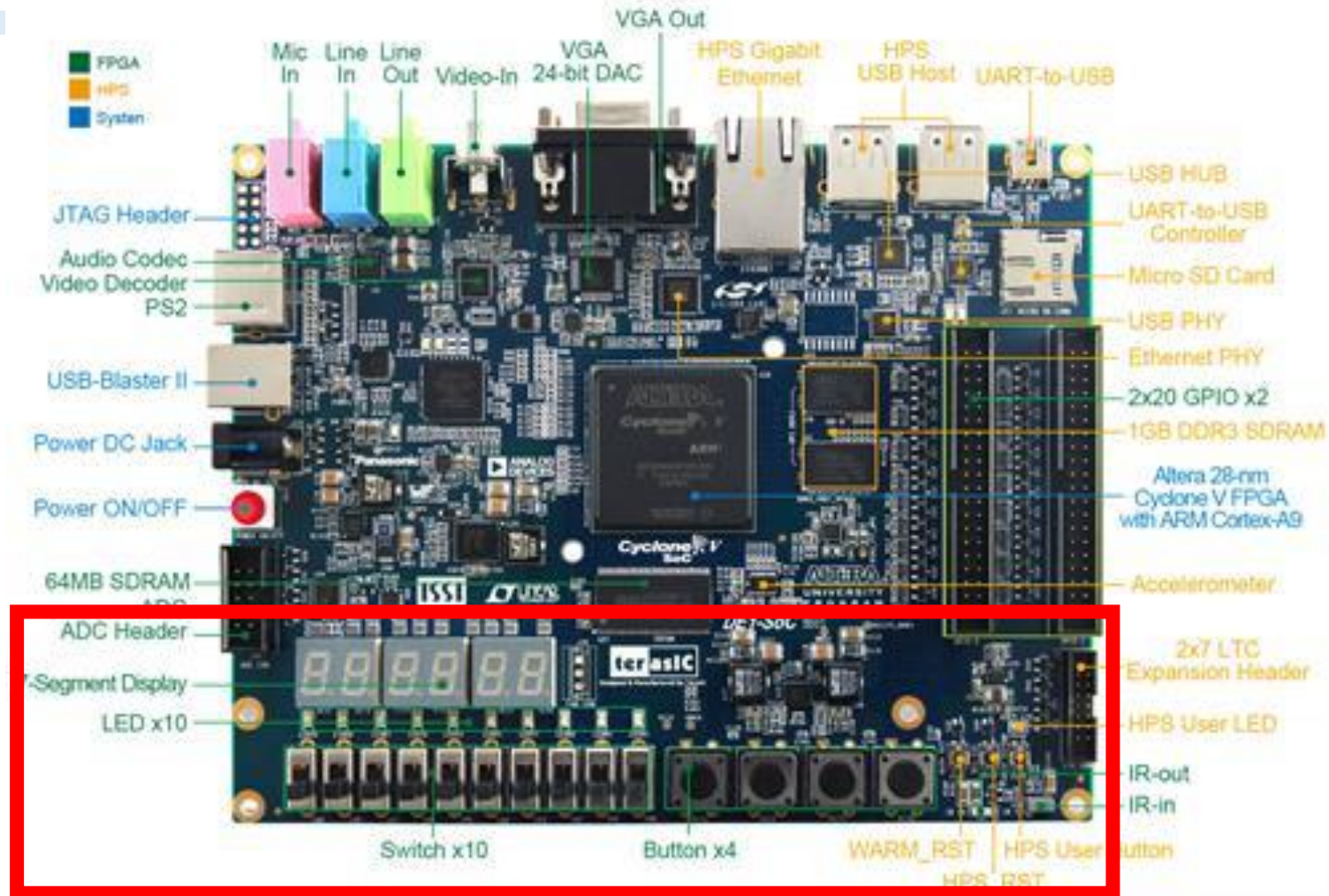
- Display letter grade, given the student's HW exam marks.
- In this imaginary class, we had 5 HW, 1Midterm, 3 labs, 1 project and 1 final. Available maximum point for each is 127 (actually 100, but 127 is possible with bonus points.) The weights are given in the table:

HW1	HW2	HW3	HW4	HW5	Project	Lab1	Lab2	Lab3	MT	Final	Total
3%	3%	3%	3%	3%	15%	5%	5%	5%	15%	40%	100%

- The letter grade will be calculated using the table below:

Percent	>90	80 - 89	70 - 79	60 - 69	<59
Letter Grade	A	B	C	D	F

# Hardware



- Input: points
  - Range : 0 -127 → 8 bits possible.
  - Format: Binary → 8 bits  
Binary coded decimal → 9 bits
  - Device: switch
  - Control device: pushbutton.
- Output: letter grade and messages for user
  - Messages: Error, H1, H2,.... Final ....
  - Then, letter grade is displayed.

# Basic flow

- Display: - - - - H 1
- Enter H1 point and press «enter»
- Display: - - - - H 2
- Enter H2 point and press «enter»
- .....
- Display: - - - - F E
- Enter Final exam point and press «enter»
- Display: - - - - A

# Possible problems and solutions

- Press «enter»
  - Problem: it is a pushbutton, it can be recognized as multiple signals.
  - Solution: add delay.
- Data
  - Problem: Wrong data is entered
  - Solution: don't worry, it is user's mistake
  - Solution: use a «clear» button
- Data
  - Problem: wrong student
  - Solution: use a «new student» or reset button
- Memory
  - Problem: why 2nd student always get A?
  - Solution: clear registers after you display the letter grade

# Possible subroutines

- State machine:
  - Display message X - read X ..... Calculate average – display letter grade - ...
- Display messages:
  - A register holds the state. The state is a binary number which should be displayed like H1, MT ....  
On the 7-segment.
- Calculate average:
  - Accumulate weighted points
- Display letter grade:
  - Find the corresponding letter
- Read input:
  - If the main program requested a new data, wait for the «enter» to be pressed and then load the SW value into a register.
- Clear
- Reset