Name: (as it would appear on official course roster)
UCSB email address: **@ucsb.edu**
Lab Section Time:
Optional: name you wish to be called if different from above
Optional: name of "homework buddy" (leaving this blank signifies "I worked alone")

Assignment 05: MIPS Floating Point

Assigned: *Friday, February 7th, 2020*
Due: *Thursday, February 13th, 2020*
Points: *60 (normalized to 100 in gradebook)*

- You may collaborate on this homework with AT MOST one person, an optional "homework buddy".
- MAY ONLY BE TURNED IN ON **GRADESCOPE as a PDF file** (see instructions in online lab01 description).
- There is NO MAKEUP for missed assignments.
- We are strict about enforcing the LATE POLICY for all assignments (see syllabus).

Only use the space provided for answers. Use clear and clean handwriting (or typing). You will get penalized if you are asked to show your calculations and do not do so.
ALWAYS SHOW YOUR WORK!

1. (20 pts) Express these single-precision floating point numbers (shown in hex) as decimal numbers.
   a. (5 pts) **0x3F400000**

   b. (5 pts) **0xBF640000**

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c. (5 pts) **0xC0020000**

d. (5 pts) **0x427FC000**

2. (5 pts) Express this *double-precision* floating point number (shown in hex) as a decimal: **0x3FFE000000000000**

3. (15 pts) Express the following decimal numbers as single-precision floating point numbers, per the IEEE 754 standard. They can all be expressed without binary decimal representation error.
   a. (5 pts) **1.625**

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b. (5 pts) **-0.8125**

c. (5 pts) **56.375**

4. (5 pts) IEEE 754 also contains a ***half precision*** that is only 16 bits wide. The left most bit is still the sign bit, the exponent is 5 bits long and has a bias of 15, and the mantissa (significand) is 10 bits long. An implicit 1 is assumed (i.e. in the "1 + F" part of the formula). Based on this description, write down the bit pattern in hexadecimal to represent **-1.5625×10^{-1}**.

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5. (15 pts) Consider the binary number $\mathbf{-1.1100\overline{1100}...}$ (where the last 4 bits keep repeating). Given a *half precision* floating point format (as described in problem #4 above):
    a. (5 pts) Calculate what *decimal number* this is and figure out what (rounded-up) decimal number that this is approximating.

    b. (5 pts) What is the error factor (the difference between the intended number and the actual binary number)? Express this in normalized scientific notation.

    c. (5 pts) What is the bit pattern in hexadecimal (in half-precision format)?