Criteria and Discussion on Homework 1

Question 1 (10%)

Criteria.

The total score for this question is 10 points, consisting of two sub-questions: converting an SID to octal and hexadecimal representations. Each sub-question is worth 5 points.

Scoring criteria are as follows:

- If the student's answer is correct, award 5 points.
- If the answer is incorrect, but the calculation process shows that the student used the correct method of repeatedly dividing the SID by 8 (or 16) and taking the remainder, consider the process correct and award 2 points.
- If the calculation process does not demonstrate the above method, no points will be given.

Question 2 (10%)

Criteria.

The total score for this question is 10 points, consisting of two sub-questions: representing the SID in BCD and ASCII codes. Each sub-question is worth 5 points.

Scoring criteria are as follows:

- The question requires only the final answer; the calculation process does not affect the score.
- Since the SID consists of eight digits, eight conversions are required. Scoring is based on the number of conversion errors:
    - No errors: award 5 points.
    - 1 to 2 errors: award 2 points.
    - 3 or more errors: no points.

Question 3 (20%)

Criteria.

This question includes two grading requirements:

- The student must correctly represent XYZ in two's complement.
- The student must correctly express the two's complement as a 16-bit binary number.

The scoring criteria are as follows:

- If the student's result is completely correct, full marks are awarded.
- If the student's result is incorrect, points are deducted based on the following rules:
    - If the two's complement is not represented as a 16-bit binary number, deduct 5 points.
    - If the two's complement calculation is incorrect:
        - If the process shows the correct method, i.e., converting XYZ to binary first, then inverting and adding 1, deduct 3 points.
        - If the method is incorrect or no calculation process is provided, deduct 15 points.

Question 4 (20%)

Criteria.

The problem requires students to calculate the binary representation of both ABC and 0.XYZ.

Scoring criteria are as follows:

- Binary representation of ABC (8 points):
    - If the student provides the correct result, award 8 points.
    - If the result is incorrect, points are awarded based on the calculation process:
        - If the process correctly shows the method of repeatedly dividing by 2 and taking the remainder, award 4 points.
        - If this method is not shown, no points are awarded.
- Binary representation of 0.XYZ (12 points):
    - If the student provides the correct result, award 12 points.
    - If the result is incorrect, points are awarded based on the calculation process:
        - If the process correctly shows the method of repeatedly multiplying by 2 and taking the integer part, award 6 points.
        - If this method is not shown, no points are awarded.

Discussion. (Rounding)

For this problem, where students are calculating the binary representation of 0.XYZ and may apply rounding (i.e., rounding up if the 7th bit is 1), the problem does not require rough estimation, but rounding is reasonable and acceptable. Therefore, the scoring criteria are adjusted as follows:

- If the student's calculation process clearly shows rounding and the result is correct, no points will be deducted.
- If the student does not provide a calculation process showing that rounding was applied but the result matches the correctly rounded outcome, deduct 2 points.

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Question 5 (20%)

Criteria.

The problem requires converting a floating-point number to its FP32 representation, with scoring divided into three parts: the sign bit, exponent bit, and fractional part. The specific grading criteria are as follows:

- Sign Bit (2 points):
  - If the sign bit is correct, award 2 points.
  - If the sign bit is incorrect, award 0 points.
- Exponent Bit (6 points):
  - If the exponent bit is correct, award 6 points.
  - If the answer is incorrect but the student demonstrates the correct approach using repeated division by 2 and taking the remainder, award 3 points.
  - If no correct approach is shown, award 0 points.
- Binary Conversion of the Fractional Part (12 points):
  - If the fractional part is correctly calculated, award 12 points.
  - If the method is entirely correct but there are errors in the calculations, the maximum score is 6 points.
  - If the method is incorrect, partial credit may be awarded, but the maximum score is 4 points.

Discussion 1. (Rounding)

For the calculation of the fractional part, students may apply rounding. Although the IEEE floating-point standard uses the round-to-nearest method and this approach is widely accepted, the course slides and problem description do not mention rounding. Therefore, rounding will not be considered the standard answer. However, considering the reasonableness of rounding, the grading criteria are as follows:

- If the student explicitly indicates they applied rounding:
  - If the rounded result is correct, no points will be deducted, and they will receive the corresponding score.
- If the student does not provide a calculation process showing that rounding was applied:
  - If their result matches the correctly rounded outcome, deduct 2 points.

Discussion 2. (Precision Loss)

Students may be influenced by the previous question (Q4) and use the result from Q4 directly for shifting and conversion. However, Q4 only retains 6 decimal places, while the FP32 standard requires 23 bits for the fractional part (plus an implicit leading 1), leading to precision loss. As a result, the student's answer might match the standard answer for the first few bits but fill the remaining bits with zeros, while the standard answer has more significant bits. Additionally, rounding immediately after normalization may also cause precision loss.

In these cases, although the student's method is correct, the precision loss causes the result to be inaccurate. The maximum score awarded for such cases is 6 points.

Question 6 (20%)

Criteria.

The calculation process for Q6 involves the following steps:

1. Calculate the correct hex representation of ABC.
2. Calculate the correct hex representation of XYZ.
3. Calculate the sum of XYZ and ABC, provided both steps 1 and 2 are correct.

Scoring criteria are as follows:

1. Hex representation of ABC (6 points):
   - If the result is correct, award 6 points.
   - If the result is incorrect but the correct approach is demonstrated (i.e., repeatedly dividing by 16 and taking the remainder), award 2 points.
2. Hex representation of XYZ (6 points):
   - Same as 1.
3. Sum of XYZ and ABC (8 points):
   - If the result is correct, award 4 points.
     - If there are errors in the hex conversions in first two steps, the result of this step will necessarily be incorrect.
   - If the student performed the hex addition as required and provided the full calculation process, award 4 points.