CSC 3210
Computer Organization and Programming
Assignment #1
Spring 2024
Due on 1/30/2024, 11:59 PM Eastern Time (US and Canada)

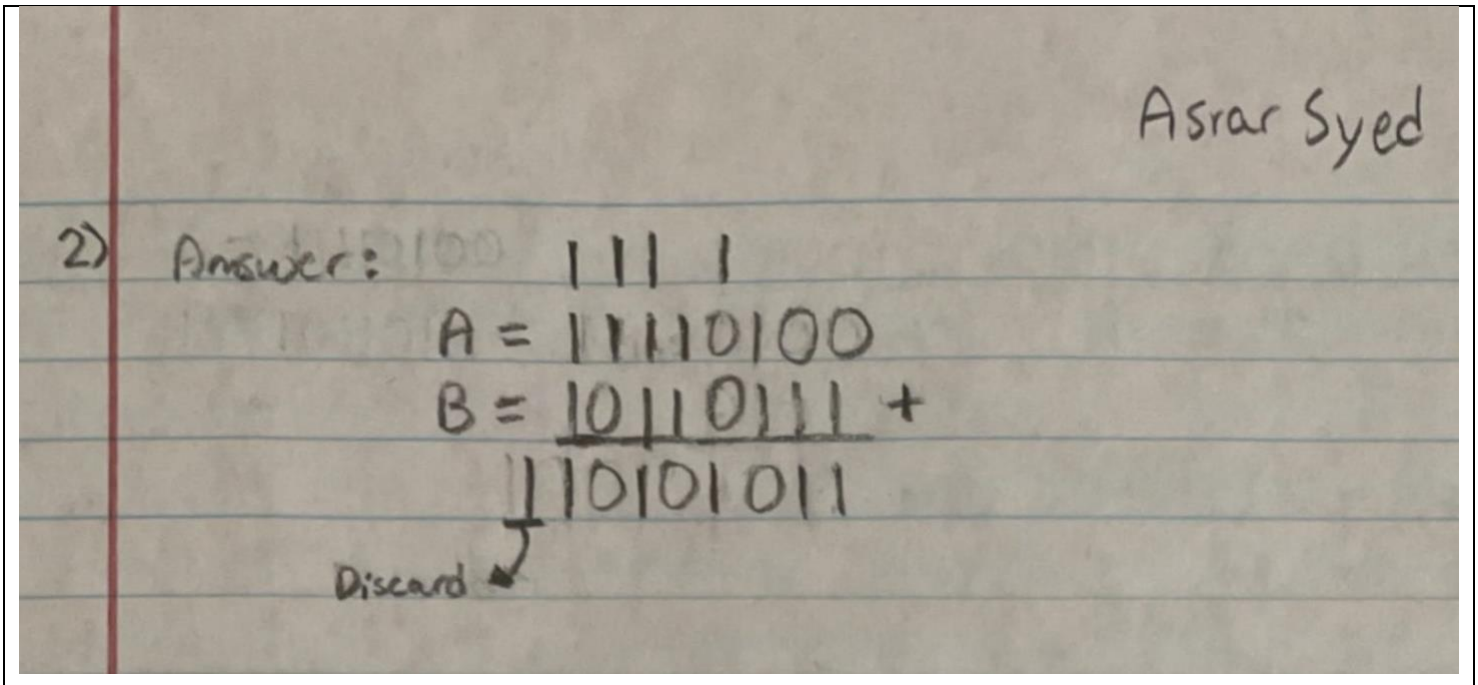
Objective: Learn some core concepts closely relating to assembly language.

Total 15 points

1. **(1 point)** Why is assembly language not usually used when writing large application programs?

It is not used in writing large application programs because it is a low-level language that is difficult for humans to read. It is more complex and time-consuming to write than higher-level languages because it lacks abstraction and features that simplify the development process. Additionally, assembly lacks portability, as programs written in assembly are often tied to specific hardware architectures, limiting their cross-platform compatibility compared to high-level languages

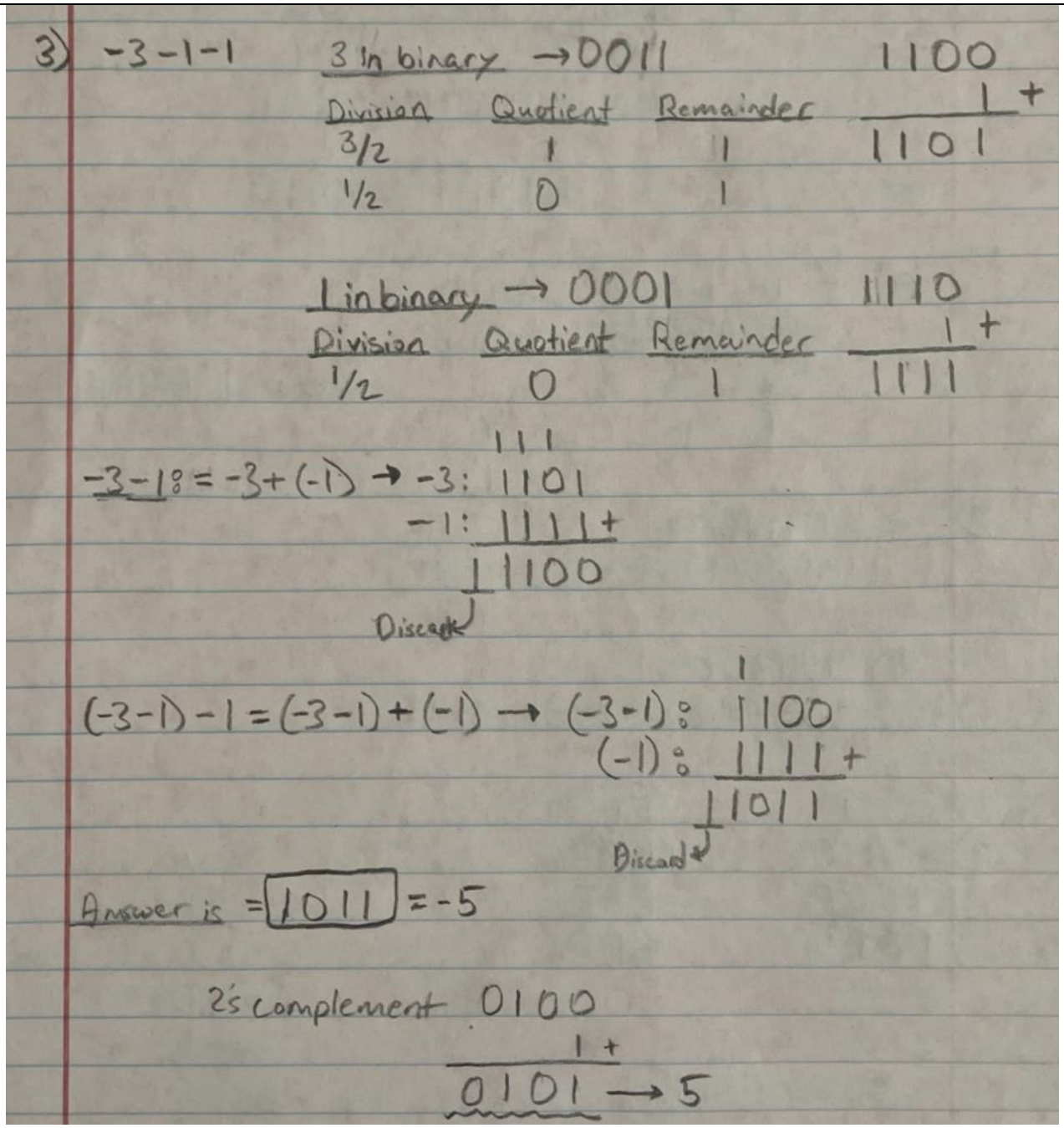
2. **(1 point)** Assume that you have three 8-bit storages (memory) named A, B, and C to store binary numbers. Memory A contains 11110100 and memory B contains 10110111. Compute A+B and store the value in C register. What is the content of register, C after the computation? **Show the computation in details with carries.**



3. **(2 points)** Assume that you have 4-bit storage to store the numbers. Calculate the following operations using **two's complement method**. Show all the computations in details. (assuming 4-bit register is used)

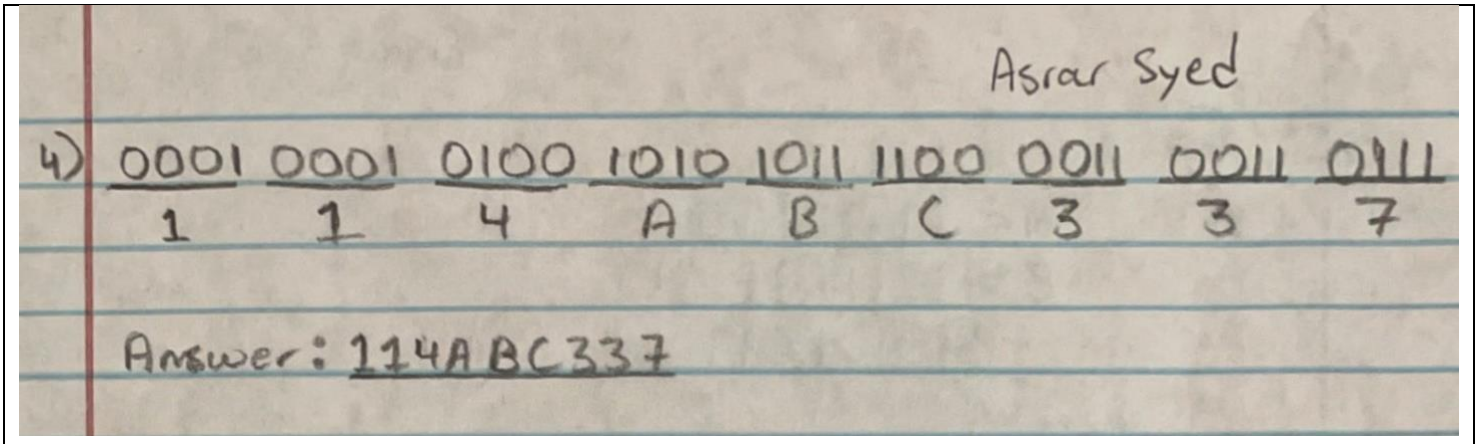
-3 -1 -1

[Hint: Perform the computation in binary system, then convert it back to decimal]



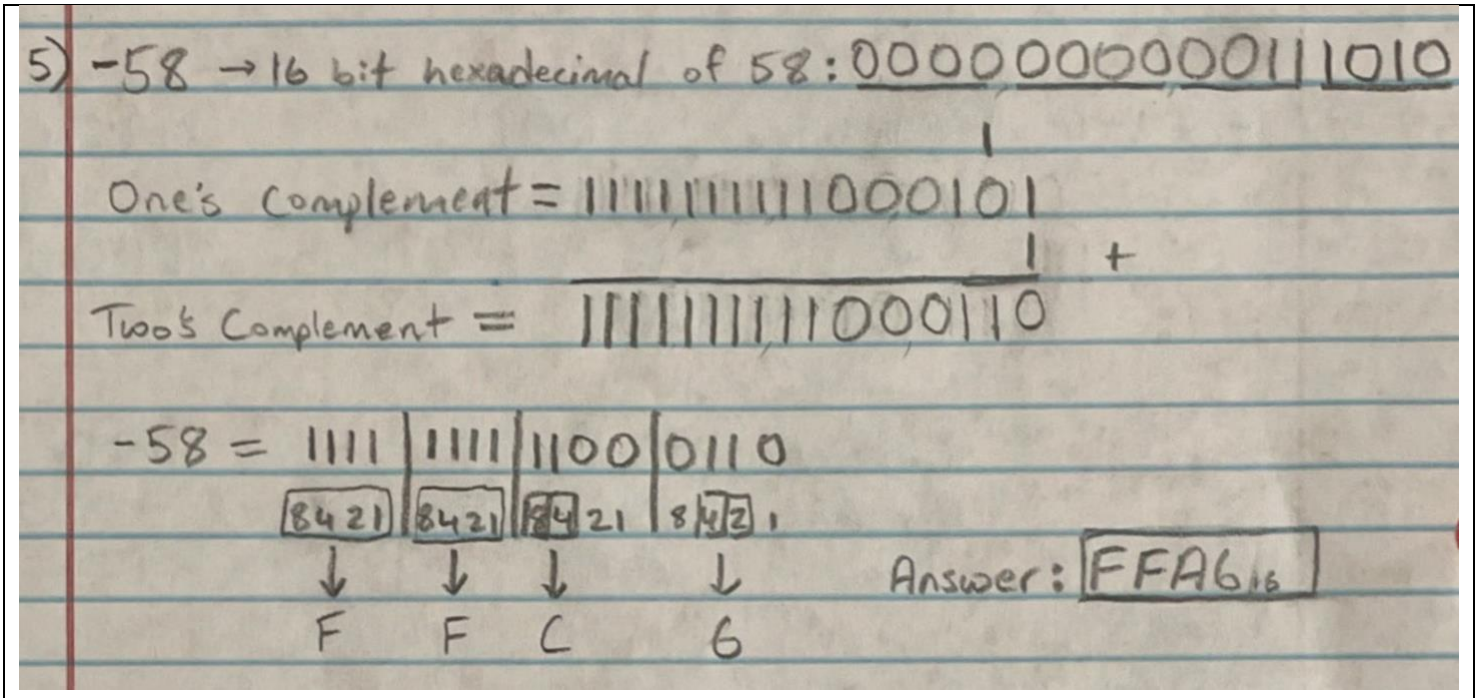
4. (1 point) What is the hexadecimal representation of the following binary numbers? **Show the conversion in details.**

1 0001 0100 1010 1011 1100 0011 0011 0111



5. (2 points) What is the *16-bit* hexadecimal representation of the following *signed decimal* integer? Show all the steps of conversion in details.

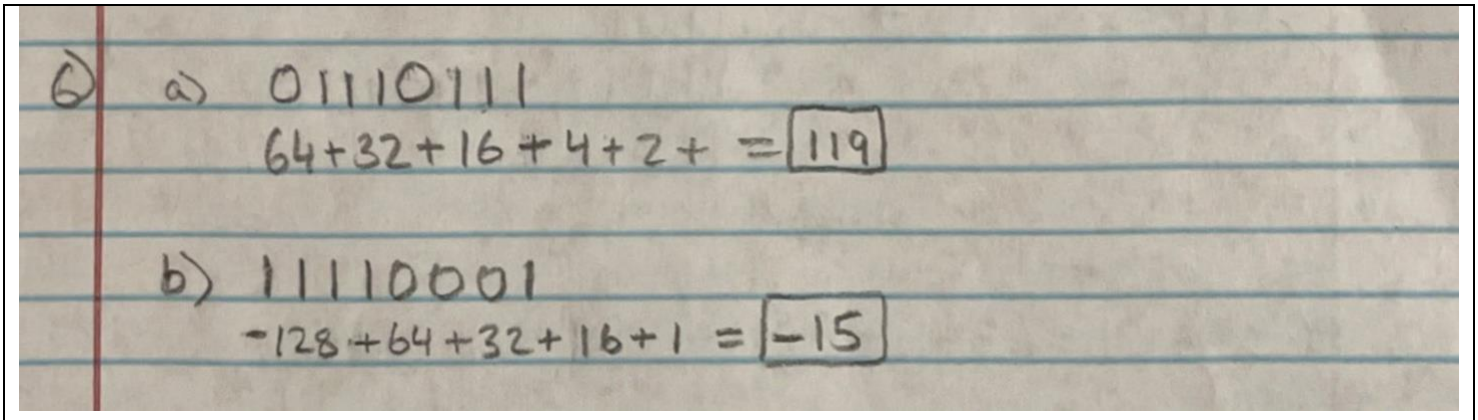
-58



6. **(2 points)** What is the decimal representation of each of the following *signed binary* numbers? Show the computation.

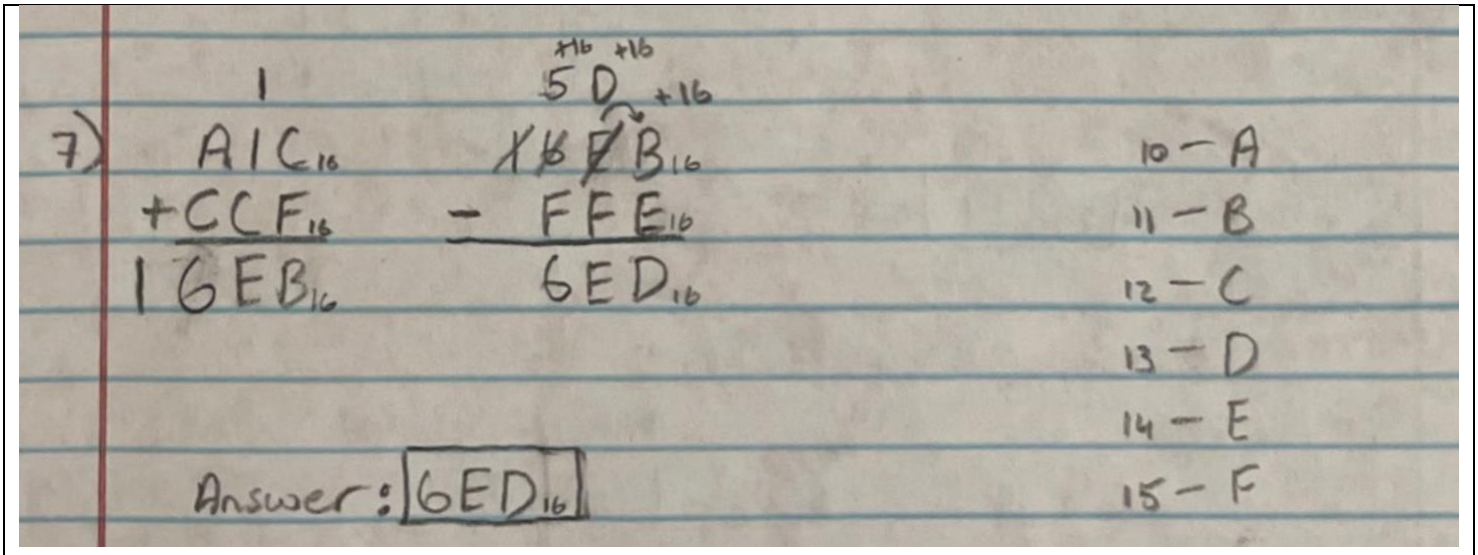
a. **(1 point)** 0111 0111

b. **(1 point)** 1111 0001



7. **(2 point)** Evaluate the following Hexadecimal expression. **All the numbers are hexadecimal**. Show all the steps of computation and the carries.

A1C + CCF - FFE



8. **(1 point)** Is it possible to store **-10** in a 4-bit storage. If your answer is YES, then show how to store **-10** in 4-bit register. If your Answer is No, Explain why.

Answer: <u>No</u> – It is not possible to store -10 in a 4-bit storage. The range for a 4-bit storage in two's complement is from is -8 to 7, and -10 falls outside the representable values. To store -10, you would need a 5-bit storage as one of the leftmost bit would be used to represent the sign bit, to indicate a negative number.

9. (1 point) What is the smallest decimal value you can represent, using a **120-bit signed integer?** You can write the number in exponent form.

The range of signed n-bit integer is –2^(n-1) to 2^(n-1) – 1.

If n = 120, then the smallest decimal value that we can represent is equal to –2^(120-1) or -2^(119).

Answer: -2^(119)

10. (2 points) What is the Boolean expression for P?

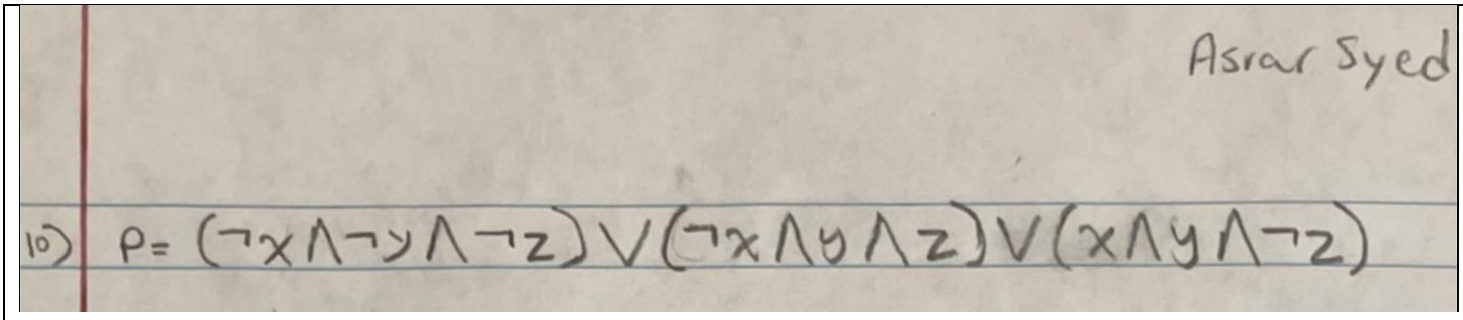
x	y	z	P
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

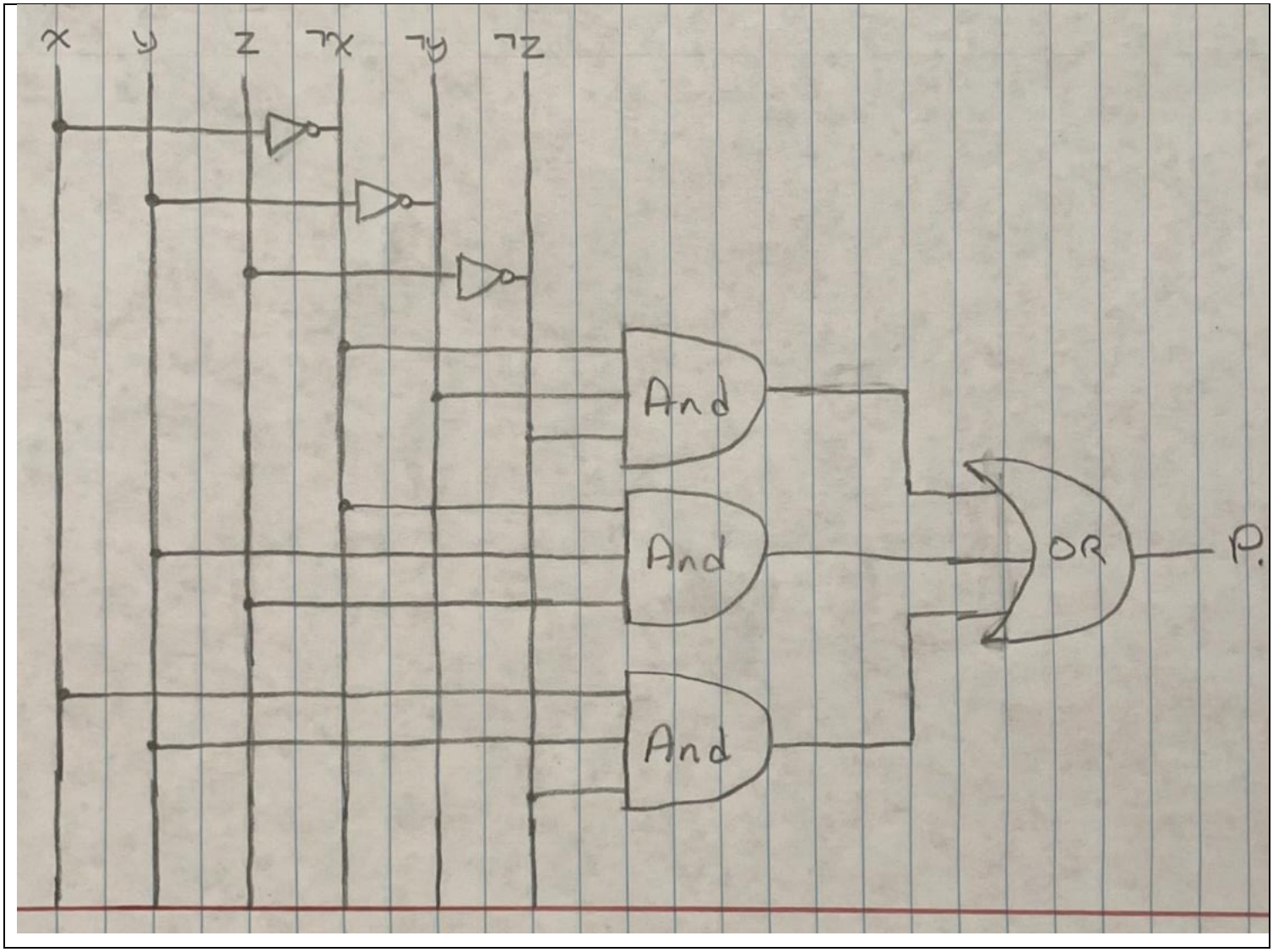
Design a circuit that can produce output P for inputs x, y, and z as expressed in the table above.

Hint:

1. When X=0, Y=0, and Z=0, P=1.
2. When X=0, Y=1, and Z=1, P=1.
3. When X=1, Y=1, and Z=0, P=1.

Write these conditions as logical expressions, and combine them using OR





Note:

- **Make sure to justify all answers – show all work.**
- The Assignment **must be submitted electronically** through iCollege.
- You can do your work in a text editor (Microsoft word, open office, etc.)
- Or you can do it in a piece of paper, then scan or take a picture of the paper.
- Upload the answers in a **pdf file** to iCollege in the respective assignment dropbox.
- All work must be neat and legible. Illegible work will receive no credit. This includes work where the print contrast or darkness are too faint.
- The work that you turn in must be your own --- copying is not allowed for any assignments.
- Using another student's work as your own, allowing another student to use your work as their own, is academic misconduct.

Late submission:

A late penalty will be applied to any submission after the due date.

- If you submit the assignment within 2 day of due date, the late penalty is 10% of the grade.
- For any assignment submitted after 2 day, the late penalty is 35%.

How to calculate the late penalty?

Let’s assume that the assignment has total point of 15. And you submitted the assignment within 2 days after the due date. After grading you received 13 out of 15 in the assignment. The late penalty will be 15% of 15 = 2.25 points. After late penalty deduction your grade is 10.75 out of 15.