

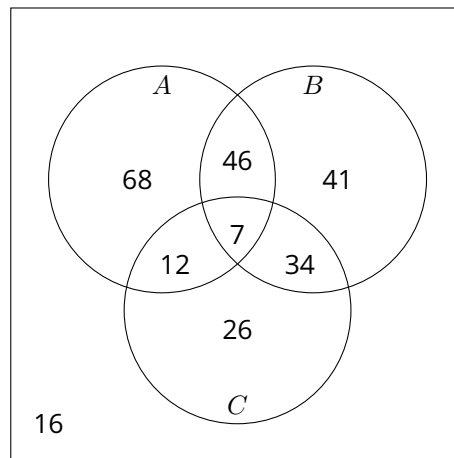
Tutorial: Revision questions

Aim

The aim of this tutorial is to revise the topics covered in this unit.

Questions

- Given the hex value 0xBE574280:
 - convert it to binary.
 - convert it to a floating point value using single precision IEEE 754 representation.
 - split the hex value in two and assume they represent a value using 16-bit two's complement. Provide the two integer values.
- Given the sequence of codepoints U+1D486 U+2115 U+0394, determine the UTF-8 representation using hex values.
- You have been given the following data about who has completed particular tasks (A, B, or C) for a particular portfolio unit.



- Using set notation, write the following expressions:
 - Those who have not done Task A.
 - Those who have done Task C but not Task B.
 - Those who have done Task A and Task B.
- Provide the counts for the following set expressions:
 - $A \setminus B$
 - $B \cup C$
 - $(A \cap C) \cup B^C$ (and is this different to $A \cap (C \cup B^C)$?)

4. Your colleague, who is new to programming, has written the following conditional statement:

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if (hour >= 12 and day == Sunday) or not(hour < 12 and day == Sunday) or day != Sunday
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This can be simplified. Convert the statements into propositional logic, and use the laws of logic to simplify the statement.

5. Swinburne students who regularly go to the Hammer and Swine bar have been complaining about the lack of lightning at the outdoor rooftop garden during the evenings. The bar manager, who cannot be bothered to control the lights, has decided to put the switch accessible to the public (Input P).

However, the bar manager is an environmentalist. He wants to add a photo-sensor (Input E, activates if there is enough natural light) into the lighting system that will not turn on the lights if activated.

Due to maintenance purposes, the bar manager wants to add a secondary hidden switch (Input H). This switch will only be used to test the photo-sensor, and turn on the lights during the day. Therefore, the hidden switch will only turn on the lights if the photo-sensor detects enough natural light.

The bar manager has asked the COS10003 students for advice in order to design a circuit that will control the lighting system.

- Draw a truth table and determine the expression for the circuit.
- Draw the circuit.

6. Given the following functions where $R = \{a, b, c, d, e\}$, $S = \{a, b, c, d\}$:

$$f : R \rightarrow R = \{(a, a), (b, c), (c, e), (d, b), (e, d)\}$$

$$g : S \rightarrow R = \{(a, a), (b, d), (c, b), (d, c)\}$$

$$h : R \rightarrow S = \{(a, b), (b, a), (c, d), (d, c), (e, a)\}$$

- determine a composition of two different functions that results in an injective function.
- determine a composition of two different functions that results in a surjective function.

7. Using the Turing machine for a palindrome, test the following tapes. Start at the first letter (not blank) on the tape.

- baaab
- baaba
- baab
- baabb

8. Take the digits 1, 2, 3, 4, 5, 6 and 7.

- How many different numbers can be made with all these digits if the digits cannot be repeated?

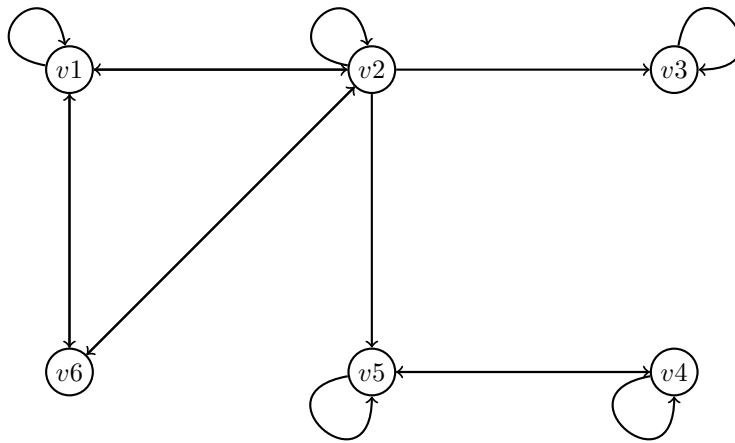
- b) How many different numbers can be made using seven digits if the digits can be repeated?
- c) How many numbers can be made with all these digits that start with the digit 4 if they cannot be repeated?
- d) How many numbers can be made with all these digits that end with the digits 23 in that order if they cannot be repeated?
- e) How many numbers can be made with all these digits with 5 in the thousands position if they cannot be repeated?
- f) If the numbers from a) are written down in numerical order, which number appears in 1000th place? How about 2000th?

9. We are interested in paths through a grid from the top left corner to the bottom right corner. Movements through the grid can only be right or down. For example, for a 2 by 2 grid, there are 6 paths.



Given a 5 by 5 grid, how many paths are possible? Can you generalise this?

10. Given the following graph, and considering each edge as an ordered pair:



Does this graph represent an equivalence relation?

11. Bonus question: for the circuit question from earlier, draw a flowchart that represents the choices made, where each decision can only contain one comparison.