

CS4261/5461: Assignment for Week 11

Due: Sunday, 9th Nov 2025, 11:59 pm SGT.

Please upload PDFs containing your solutions (hand-written & scanned, or typed) by 9th Nov, 11:59 pm to **Assignments/Assignment11/Submissions**. Name the file **Assignment11_SID.pdf**, where SID should be replaced by your student ID.

You may discuss the problems with your classmates or read material online, but you should write up your solutions on your own. Please note the names of your collaborators or online sources in your submission; failure to do so would be considered plagiarism.

Note: For this assignment, justification is required for all questions.

1. (7 points, graded for correctness) Consider an instance of approval committee voting with $n = 6$ voters, $m = 4$ candidates, and a target committee size of $k = 3$. The approval sets are given by
 - $A_1 = A_2 = \{a, b, c\}$
 - $A_3 = \{a, b\}$
 - $A_4 = \{c\}$
 - $A_5 = \{b, d\}$
 - $A_6 = \{d\}$
 - (a) (1 point) Determine all possible committees output by AV.
 - (b) (2 points) Determine all possible committees output by CC.
 - (c) (2 points) Compute the PAV score of the committee $\{a, b, c\}$.
 - (d) (2 points) Determine all possible committees output by MES. (If MES chooses fewer than k candidates, fill in the rest of the committee by maximizing the approval score.)
2. (1 point) Prove that a committee output by GreedyCC always satisfies JR.

3. (1 point) Assume that n is divisible by k , and let W be a committee satisfying EJR. Let t be a positive integer, and let S be a t -cohesive group of voters. Prove that

$$\frac{1}{|S|} \sum_{i \in S} u_i(W) > \frac{t-1}{2}.$$

(**Hint:** Apply the EJR condition repeatedly.)

Well, that's it, everyone! Hope these assignment problems were (at least at times!) fun ☺