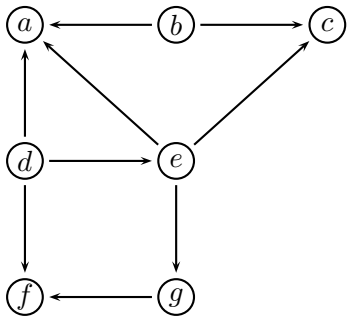
**Department of Computing and Information Systems**
**COMP90038 Algorithms and Complexity Tutorial Week 6**

## The exercises

1. Apply the DFS-based topsort algorithm to linearize the following graph:




2. Apply selection sort to the list:

$$S, O, R, T, X, A, M, P, L, E$$

3. Apply insertion sort to the list:

$$S, O, R, T, X, A, M, P, L, E$$

4. For what kind of array is the time complexity of insertion sort linear?

5. Trace how interpolation search proceeds when searching for 42 in an array containing (in index positions 0..21)

$$20, 20, 21, 23, 25, 26, 26, 27, 29, 29, 29, 30, 32, 33, 34, 36, 38, 40, 41, 43, 43, 45$$

6. For evenly distributed keys, interpolation search is $O(\log \log n)$. Show that $\log \log n$ has a smaller order of growth than $\log n$. Hint: Differential calculus tells us that $(\log x)' = \Theta(\frac{1}{x})$ and the chain rule says that $(f \circ g)'(x) = f'(g(x))g'(x)$.

7. Trace how QuickSelect finds the median of 39, 23, 12, 77, 48, 61, 55.

8. We can use QuickSelect to find the smallest element of an unsorted array. How does it compare to the more obvious way of solving the problem, namely scanning through the array and maintaining a variable *min* that holds the smallest element found so far?