Recitation 9

DFS

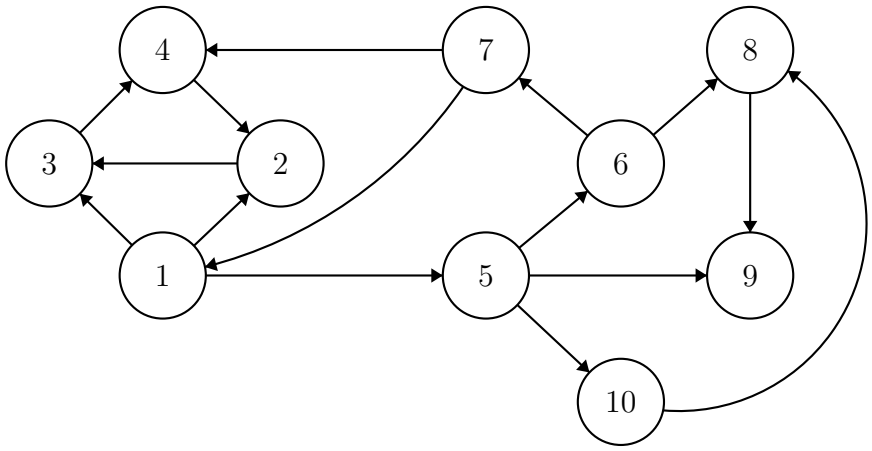
9.1 Announcements

- *BridgeLab* has been released, and is due **Thursday night**. It's worth 125 points.
- *ShortLab* will be released on **Thursday**.

9.2 DFS Trees and Numberings

Task 9.1. *Starting at vertex 1, execute DFS on the following graph, visiting vertices in increasing order. Trace the process by doing each of the following.*

1. *Draw the resulting DFS tree. Draw tree edges as solid lines, and include non tree edges in your drawing as dashed lines.*
2. *Classify each non tree edge as one of **forward**, **back**, or **cross**.*
3. *Label each vertex with its discovery and finish times.*



Task 9.2. *Suppose DFS is run on a directed graph, and consider some edge (x, y). Use the discovery and finish times of x and y to classify this edge.*

9.2.1 Higher-Order DFS

Recall the following code from the textbook:

Algorithm 9.3. *Directed, generalized DFS.*

```
directedDFS (revisit,discover,finish) (G,Σ0,s) =
  let
    DFS p ((X,Σ),v) =
      if (v ∈ X) then (X,revisit (Σ,v,p)) else
      let
        Σ' = discover (Σ,v,p)
        X' = X ∪ {v}
        (X'',Σ'') = iterate (DFS v) (X',Σ') (N_G^+(v))
        Σ''' = finish (Σ',Σ'',v,p)
      in
        (X'',Σ''')
      end
  in
    DFS s (({},Σ0),s)
  end
```

Task 9.4. *Define Σ_0, `revisit`, `discover`, and `finish` to calculate DFS numberings.*

Task 9.5. *Modify the given generalized DFS code to work with undirected graphs.*

(Hint: We only want to traverse each edge once! Try implementing undirected cycle detection with the above algorithm and see where it fails.)

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