



Sample Exam Questions

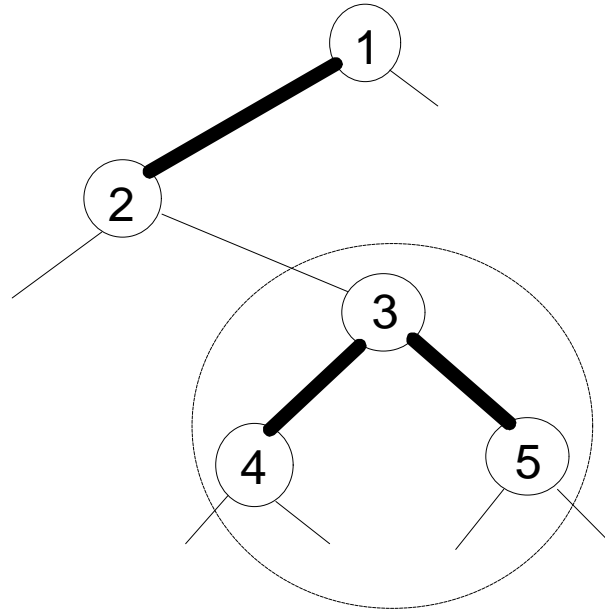
for

Analysis of Algorithms

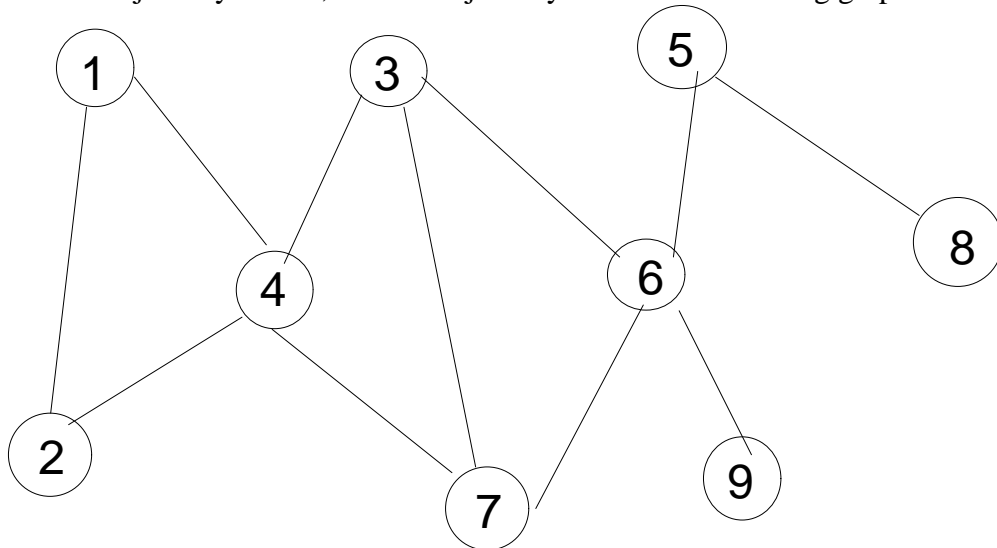
by

Peter M. Maurer

- Suppose that you are adding keys to a red-black tree, starting with an empty tree. The keys are added in this order: 1,2,3,7,5,4. Show the red-black tree at each intermediate step.
- The following are segments of a Red-Black tree, with the heavy lines representing the red edges. Show how to split the 4-node represented by the three circled vertices.

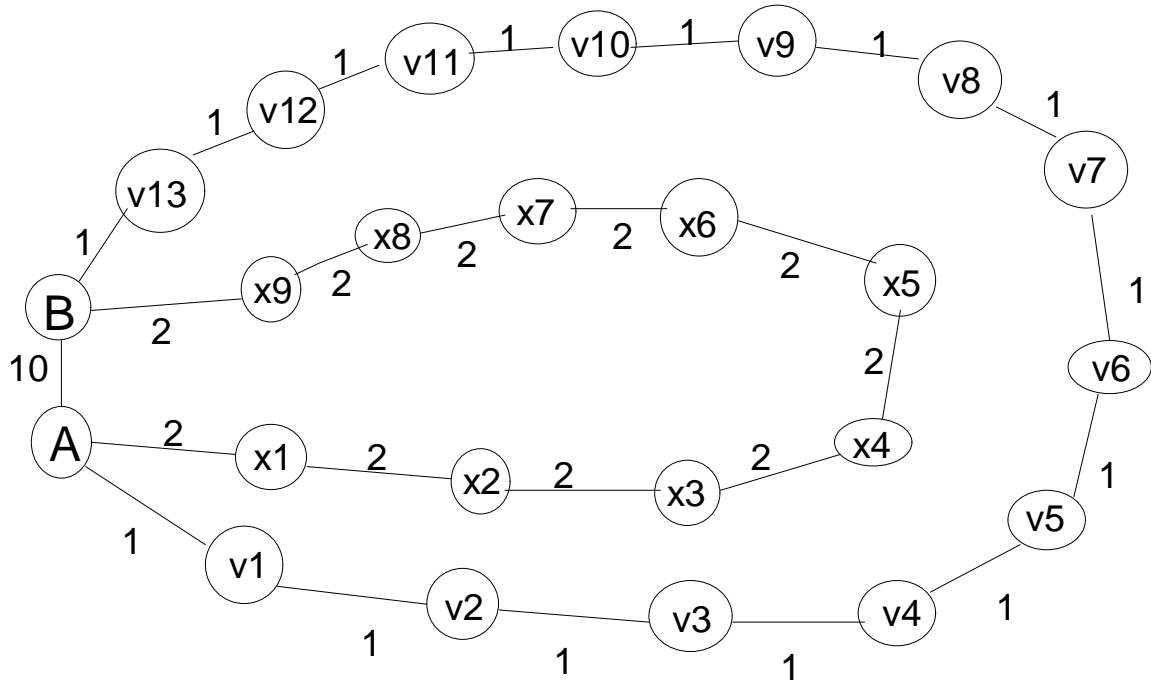


- Describe a hashing algorithm that will work for strings of 8-characters each.
- Show the adjacency matrix, and the adjacency list for the following graph.

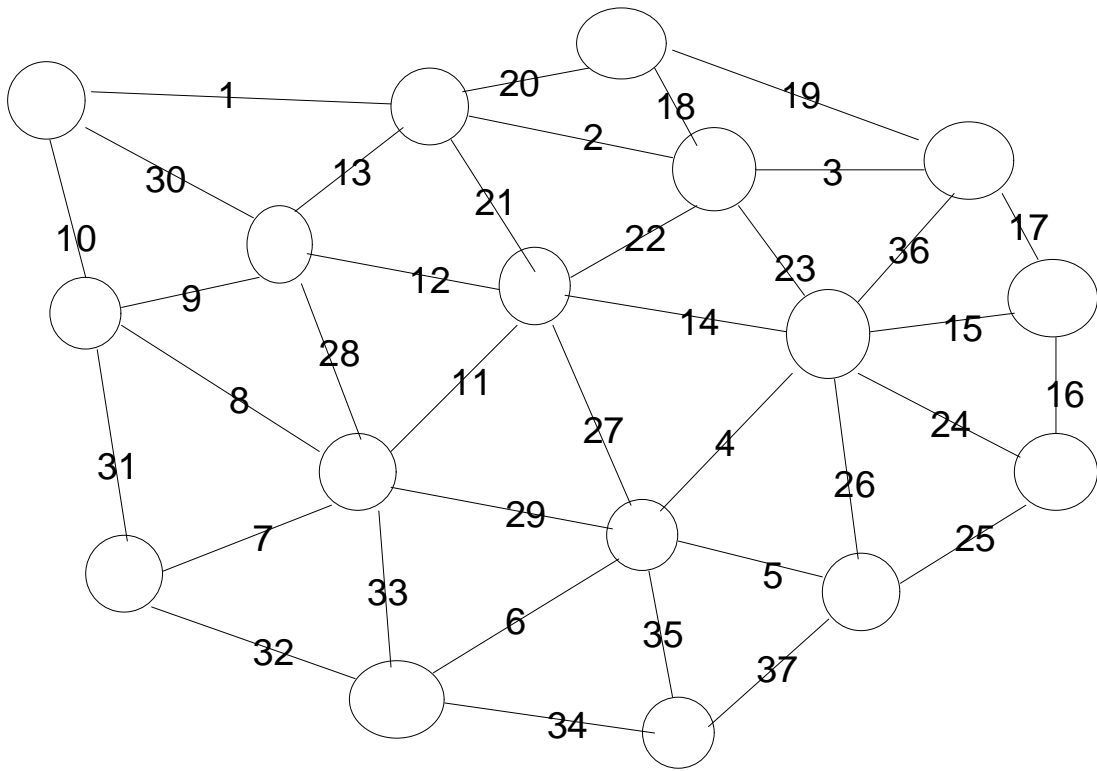


- Find the biconnected components of the above graph.

7. Find the shortest path from A to B. Show the final tree when the shortest path is found.



8. Find the minimum spanning tree of the following graph.



8. What does the term "NP-Complete" mean?

Compute the running time of the following algorithms.

```
A=0;
for (I=0 ; I<N ; I++)
{
    A++;
}
```

```
A=0;
for (I=0 ; I<N ; I++)
{
    for (J=0 ; J<I ; J++)
    {
        A++;
    }
}
```

```
A=0;
for (I=0 ; I<N ; I++)
{
    for (J=0 ; J<N ; J++)
    {
        for (K=0 ; K<N ; K++)
        {
            A++;
        }
    }
}
```

```
XRTN(N:Integer)
{
    if (N<=0)
    {
        return 0;
    }
    A=0;
    for (I=0 ; I<N ; I++)
    {
        A++
    }
    A += XRTN(N/2);
    A += XRTN(N-(N/2));
    return A;
}
```

1. Fix Bubble-Sort (page 101) to stop early if the list is already sorted.
2. Show the successive SPLIT operations that quicksort would perform on the following list.
5 11 8 2 4 1 13 15 7 6 3 9 12 14 10
3. Show the individual Merge steps on the following list for Merge sort
5 11 8 2 0 4 1 13 15 7 6 3 9 12 14 10
4. Convert the following list to a heap. Show the order of the elements after this has been finished.
5 11 8 2 4 1 13 15 7 6 3 9 12 14 10
5. For the previous heap, show the state of the list after the first three elements have been placed in their proper positions.
6. For the following list, how many times will Insertion Sort move a key?
5 11 8 2 4 1 13 15 7 6 3 9 12 14 10
7. For the same list, how many times will Selection Sort move a key?