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Homework: Making a Good Technical Argument

1.
The degree of a particular vertex cannot be more than the amount of vertices in the graph to which it belongs. Thus, if there are v vertices, the maximum degree of a particular vertex is v-1 and the minimum degree is 0.
Thus, there are v vertices and only v-1 possibilities of the degree for a particular vertex. By the pigeonhole principle, 2 vertices will share the same degree. In other words, if we assign all v vertices a degree, one degree value must repeat because there are fewer degree values than there are vertices.

2.
Explanation of algorithm:
Analyze flips in sets of 2 flips. If a set of 2 flip results contains both a 0 and a 1 (as opposed to 0 and 0, or 1 and 1), add the first flip result of that set to the final result.

Pseudocode:

```
flip_results = array of flip results with elements containing either 1
or 0
random_sequence = array to hold the produced random sequence
while i < length of flip_results{
      if flip_results[i] != flip_results[i+1]{
            append flip_results[i] to random_sequence
      }
      i = i + 2
}
```

Proof:
- If the probability of heads is p, the probability of tails is 1 - p
  - In other words: Pr(heads) = p, Pr(tails) = 1 - p
- The probability of a result of sequence {heads, tails} is equal to Pr(heads)*Pr(tails)
- Similarly, the probability of a result of sequence {tails, heads} is equal to Pr(tails)*Pr(heads)
  - Pr({heads, tails}) = p*(1-p)
  - Pr({tails, heads}) = (1-p)*p
- Therefore, Pr({heads, tails}) = Pr({tails, heads})
- Therefore, if we consider each set of two results containing a heads and tails, by repeatedly picking the first of each set of two, we can produce a random sequence.
- QED