MATH 10B with Prof. Stankova
Section #209 ; time: 3:30-5pm
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Student:
SID:
Tue 2/19/19

Quiz 4

True/False - No explanation needed. (1pt for correct, 0pt - no answer, -1pt - incorrect)

1. The bubble sort algorithm runs faster for the list of increasing order compared to that of random order. True/False
   False. The buble sort algorithm still goes through the whole procedure, i.e. comparing all adjacent pairs, when running.
2. Suppose there are n men and n women that have the strictly opposite preferences, i.e. all men prefer $w_n > w_{n-1} > ... > w_1$, all women prefer $m_1 > m_2 > ... > m_n$. If we run the stable matching algorithm to couple them, the result is unstable, i.e. there is at least one couple who both can find a better match. True/False
   False. The stable matching algorithm always gives the stable result.

Problems - Need justification. No justification means **zero**!

1. (10pts) Prove, for all positive integer n:

$$\frac{1}{2*4} + \frac{1}{4*6} + \frac{1}{6*8} + ... + \frac{1}{2n*(2n+2)} = \frac{n}{4n+4}$$

Step 1: Check with n = 1

$$\frac{1}{2*4} = \frac{1}{4*1+4} = \frac{1}{8}$$

Step 2: Assume the statement is correct up to $n = k$, i.e.

$$\frac{1}{2*4} + \frac{1}{4*6} + \frac{1}{6*8} + ... + \frac{1}{2k*(2k+2)} = \frac{k}{4k+4}$$

Step 3: Prove the statement is correct with $n = k+1$, i.e.

$$\frac{1}{2*4} + \frac{1}{4*6} + \frac{1}{6*8} + ... + \frac{1}{2k*(2k+2)} + \frac{1}{2(k+1)*(2(k+1)+2)} = \frac{k+1}{4(k+1)+4}$$

$$LHS = \frac{k}{4k+4} + \frac{1}{(2k+2)*(2k+4)} = \frac{k}{4(k+1)} + \frac{1}{4(k+1)*(k+2)}$$

$$= \frac{1}{4(k+1)}\left[k + \frac{1}{k+2}\right] = \frac{1}{4(k+1)}\frac{k^2+2k+1}{k+2} = \frac{1}{4(k+1)}\frac{(k+1)^2}{(k+2)}$$

$$\frac{k+1}{4(k+2)} = \frac{k+1}{4k+8} = RHS$$

Conclusion: The statement is correct.