Problems for exercise 8 (PA & bandgap references)

1. a. A single-ended power amplifier is built using a common-source connected transistor with an RF choke connected from the drain terminal to the supply. 130-nm CMOS technology is used with a supply of 1.2V. To maximize efficiency you want to maximize the output voltage amplitude at the drain terminal. Compromises lead to the choice of a $2V_{pp}$ amplitude. Design L-networks assuming ideal inductors and capacitors that transform the antenna impedance to an impedance suiting the amplifier for the two cases below:

   DECT: R_{ant}=50Ω, P_{out}=24dBm, f=1.9GHz
   Bluetooth: R_{ant}=50Ω, P_{out}=0dBm, f=2.4GHz

   How large is the inductor current in the two cases? How large is the bandwidth?

   b. How large bias current is required for class A operation in the two cases? If the transistor is minimum length and operates in class A, how wide must it be to avoid operating in the triode region at any time? Use long channel equations.

   Observe that the transistor can be large for the DECT case.

2. Problem 10.11a,b (solved by the teacher)

3. Problem 10.4

   Hint: find the V_{out} that gives I_1=I_2 in the figure. Use I_C=I_E*β/(β+1). Compare the solution for infinite and finite β, the difference is the error V_{err}.