Exercises part 2
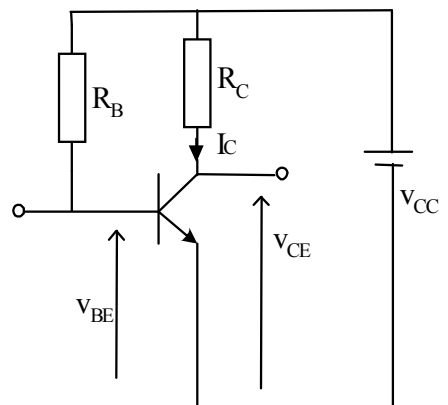
1. Consider the circuit shown opposite.

   a) What are the disadvantages of the biasing arrangement?
   b) The circuit is to be designed such that V_{CE} is fixed at ~V_{CC}/2. Why would this be desirable?
   c) What is the voltage gain of the circuit?
   d) What is the effect on the voltage gain of increasing R_C subject to the constraint of b)?

Solution
   a) The resistor R_B is used to try to fix the DC base current hence the collector current. This does not provide for stability of the bias current (I_C) as I_B will drift with temperature. Four resistor biasing provides a far better solution; in particular, the emitter resistor provides DC feedback which helps to stabilise the collector current against temperature effects. (See the text books for more detail)
   b) Allows for a symmetrical swing for ac signals at the output.
   c)

$$A_V = g_m \times R_C = 40 \times I_C \times \frac{V_{CC} - {V_{CC}}/{2}}{I_C}$$

$$= 20 \times V_{CC}$$

   d) Increasing R_C with V_{BE} fixed would cause V_{CE} to decrease as I_C would be unchanged. To restore V_{CE} to V_{CC}/2, would be necessary to increase R_B so as to reduce I_B and hence I_C. Hence the gain would be unchanged (remember the ac input would be ac coupled via a coupling capacitor on the input.