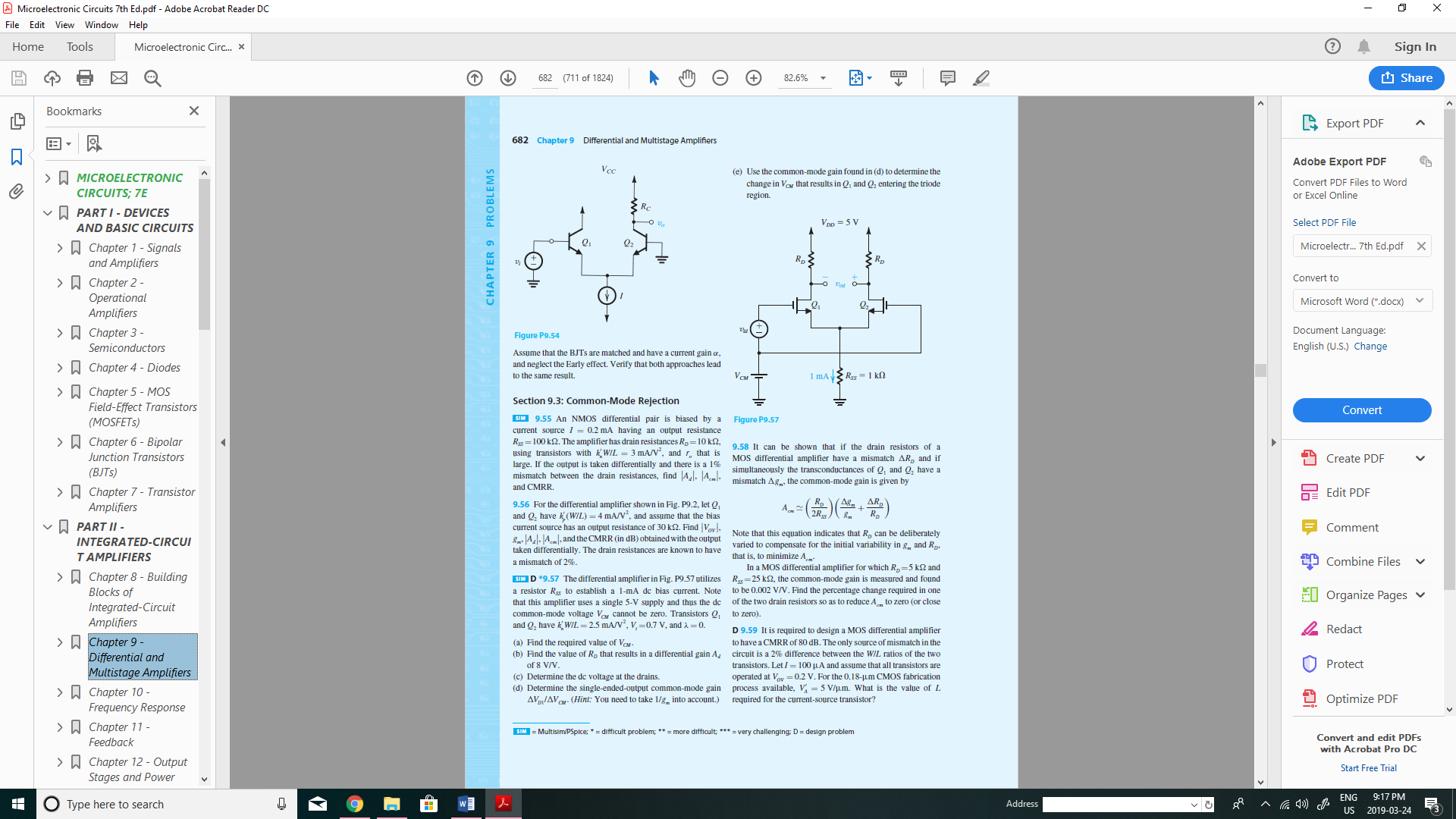
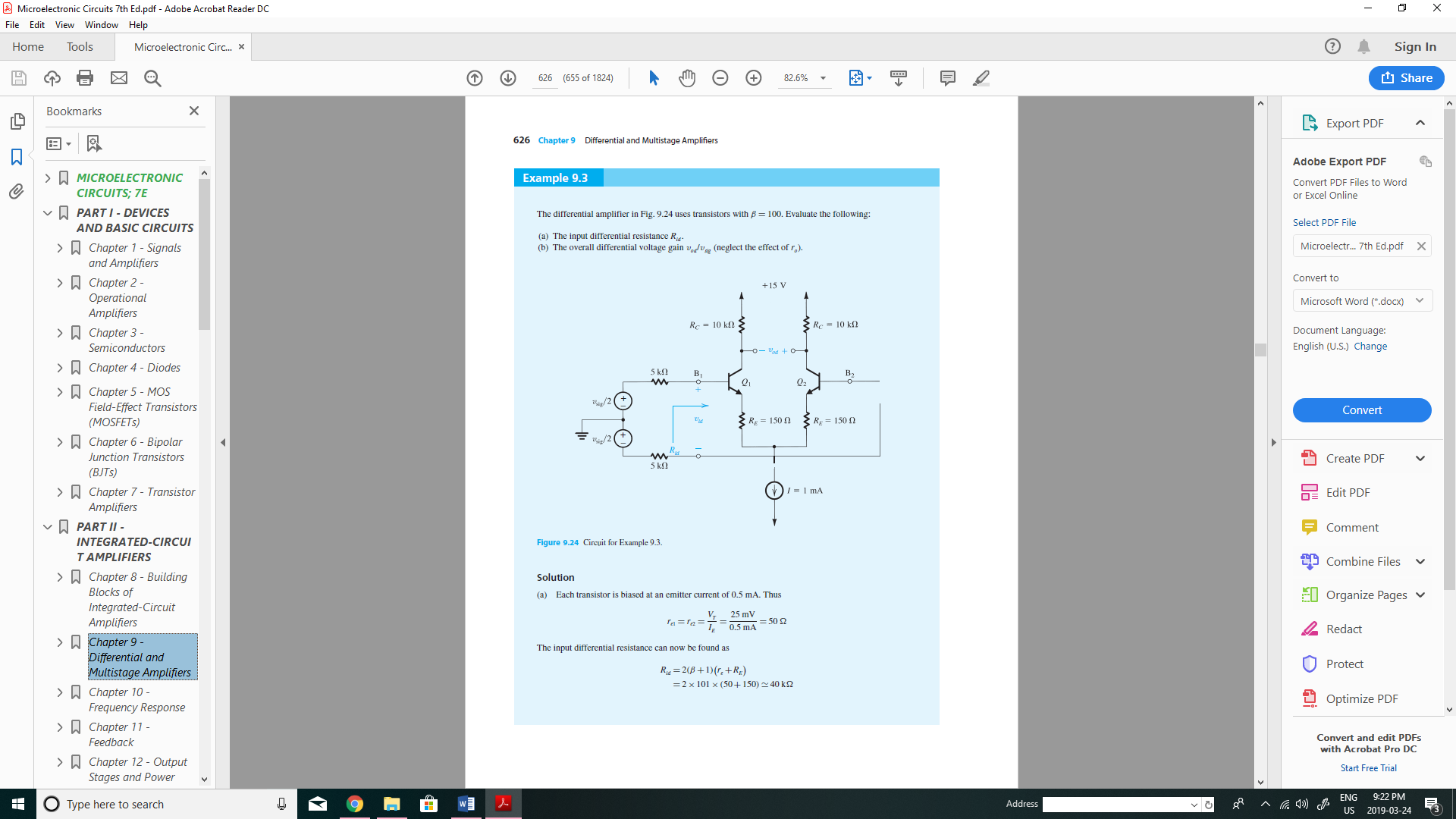
Q1. In the differential amplifier shown in figure, the MOS devices are identical and the parameters are: Further, . Calculate such the dc (bias) drain voltages are . Then, calculate the differential voltage gains, and

Q2. The differential amplifier in figure utilizes a resistor to establish a 1 mA dc bias current. Note that this amplifier uses a single 5-V supply and thus the dc common mode voltage cannot be zero. Transistors and have , and .

1. Find the required value of .
2. Find the value of that results in a differential gain
3. Determine the dc voltage at the drains.
4. Determine the single-ended-output common-mode gain .
5. Calculate CMMR in dB.
6. Use the common-mode gain found in (d) to determine the change in that results in and entering the triode mode.

Q3. A MOS differential amplifier is operated at a total current of 0.8 mA using transistor with a W/L ratio of 100, and . Find and .

Q4. The differential amplifier in figure uses transistors with Evaluate the following.

1. The input differential resistance, .
2. The overall differential voltage gain (neglect the effect of ).

Q5. An NMOS differential amplifier employing equal drain resistance of has differential gain of of 20 V/V.

1. What is the value of for each of the two transistors?
2. In each of the two transistors is operating at an overdrive voltage , what must the value of be?
3. For , what is the dc voltage across each ?
4. If is 20mV peak-to-peak sine wave applied in a balanced manner but superimposed on , what is the peak of the sine wave signal at each drain?
5. What is the lowest value that must have to ensure saturation-mode operation for and at all times? Assume