EXAM

1. (30 points) Consider the following hot and cold streams

	Supply T (°C)	Target T (°C)	ΔH (MW)	F*Cp (MW °C^{-1})
Cold	20	180	32.0	0.2
Hot	150	40	-31.5	0.15
Cold	140	230	27.0	0.30
Hot	220	80	-30.0	0.25

Use HRAT=20 to obtain the minimum utility and the pinch temperature. You can use the Excel from IChemE or hand calculations.

- Pinch temperature 150 °C (6)
- Hot Pinch 160 °C (6)
- Cold Pinch 140 °C (6)
- Minimum hot utility 6.5 MW (6)
- Minimum cold utility 14.0 MW (6)

2. (25 points) Explain graphically why the minimum energy consumption increases with HRAT. Hint: Remember the overlap.

- As the HRAT increases, the distances between cold and hot composite curve increases. (5) / Draw the hot and cold composite curves and show the allocation of HRAT (5)
- This allows the overlap between the two composite curves to be minimized and hence reducing the heat recovery (10)
- Reducing heat recovery thereby maximizes the external requirements for utility and maximizes the energy consumption (10)

3. (15 points) Explain graphically, how do you obtain the minimum area of a network for a given HRAT?
   - A balanced composite curve is first constructed/ Draw the hot and cold composite curve (5)
   - The composite curves are divided into vertical enthalpy intervals (5)
   - Each interval can be calculated by $A = \frac{\Delta H}{U\,\Delta T_{LM}}$ (5)
   - The total minimum area of the given network can be obtained from the sum of areas for each interval.

4. (15 points) A problem has 3 hot streams and one cold stream. Assuming that two utilities (one heating and one cooling) is used. What is your prediction of the minimum number of exchangers?
   - Nmin = 4 (If consider pinch)
   - Nmin = 5 (If doesn't consider pinch)
   - Both are correct (15)

5. (15 points) The purpose of Supertargeting is
   a. Design a Heat exchanger Network
   b. Obtain minimum utility for a given area
   c. Obtain the optimal HRAT
   d. Determine the minimum area
   e. None of the above