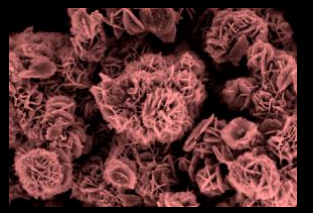
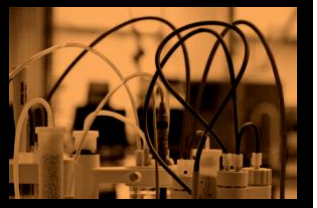




Chemical Engineering

Inspiring Potential · Generating Futures

UNIVERSITI TEKNOLOGI PETRONAS

CDB 4313Z – HEAT INTEGRATION

AUTOMATED TARGETING

ZULFAN ADI PUTRA, PDENG

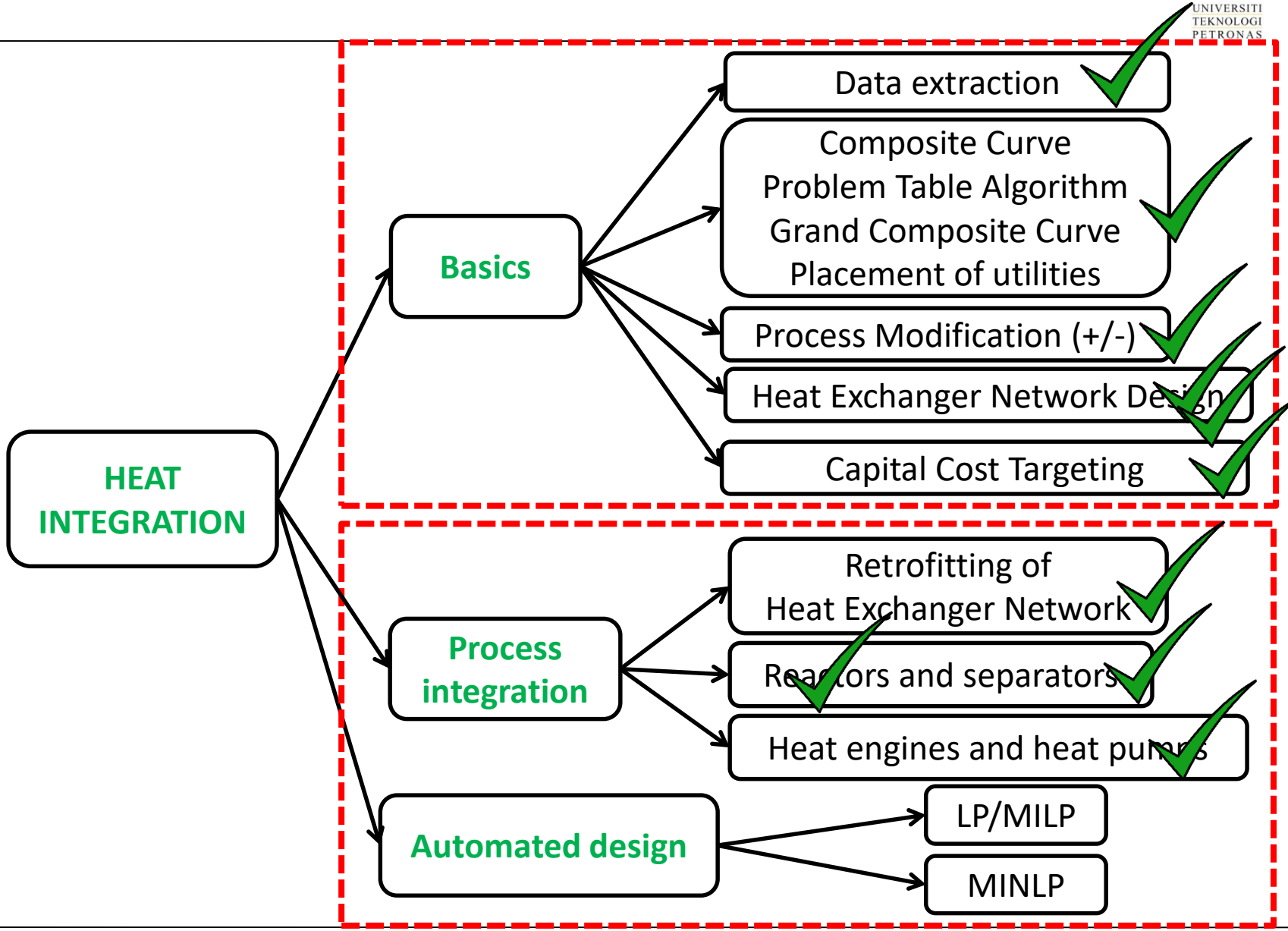
OFFICE: 05-03-08
TELP: 05 368 7562
EMAIL: zulfan.adiputra@utp.edu.my

Discussion time: Friday 15.00 – 17.00

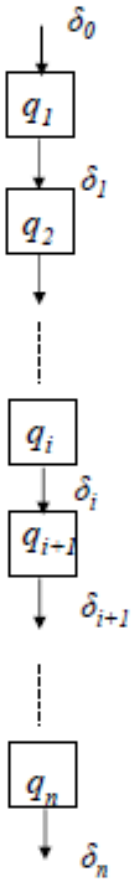
Chemical Engineering
Inspiring Potential·Generating Futures

COURSE OVERVIEW

UNIVERSITI TEKNOLOGI PETRONAS



TRANSSHIPMENT MODEL



Let q_i be the surplus or demand of heat in interval i.
It is given by:

$$q_i = \sum_{k \in \Gamma_i^H} F_k^H cp_k^H (T_{i-1} - T_i) - \sum_{s \in \Gamma_i^C} F_s^C cp_s^C (T_{i-1} - T_i)$$

The minimum heating utility is obtained by solving the following linear programming (LP) problem

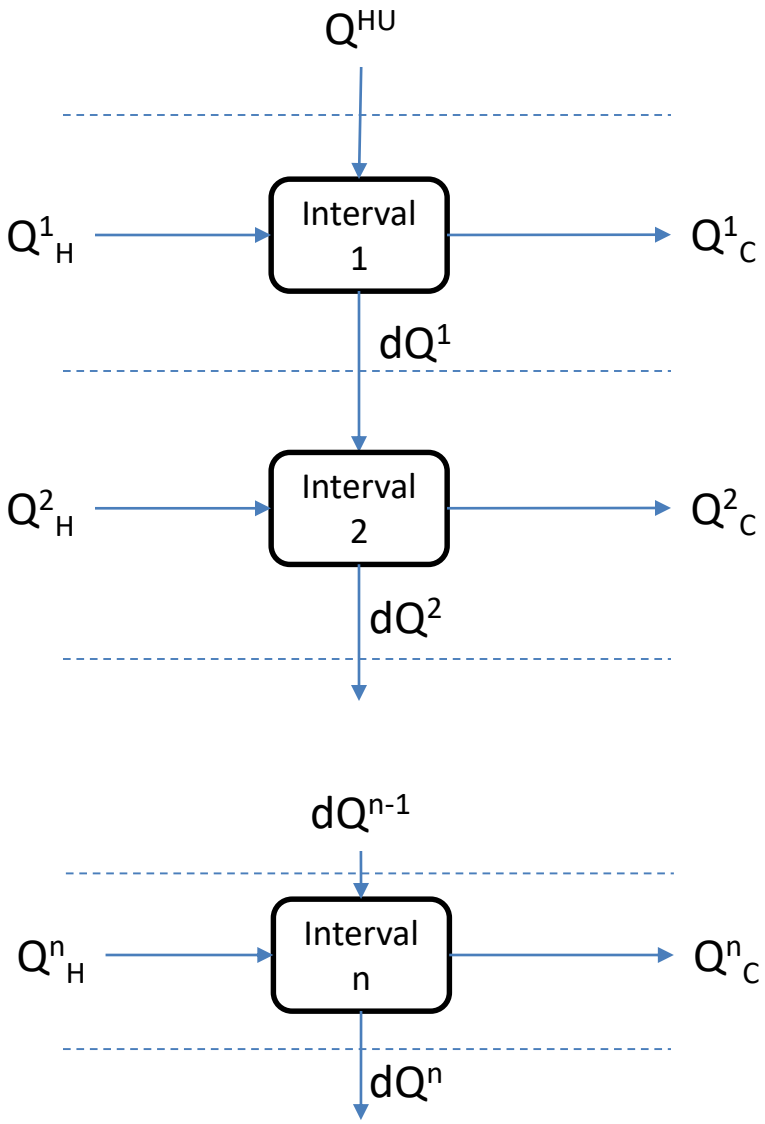
$$S_{\min} = Min\ \delta_0$$

$$s.t$$

$$\delta_i = \delta_{i-1} + q_i \quad \forall i = 1, \ldots m_I$$

$$\delta_i \geq 0$$

TRANSSHIPMENT MODEL



$$dQ^1 = Q^1_H - Q^1_C + Q^{HU}$$

$$dQ^2 = Q^2_H - Q^2_C + dQ^1$$

.
.
.

$$dQ^n = Q^n_H - Q^n_C + dQ^{n-1}$$

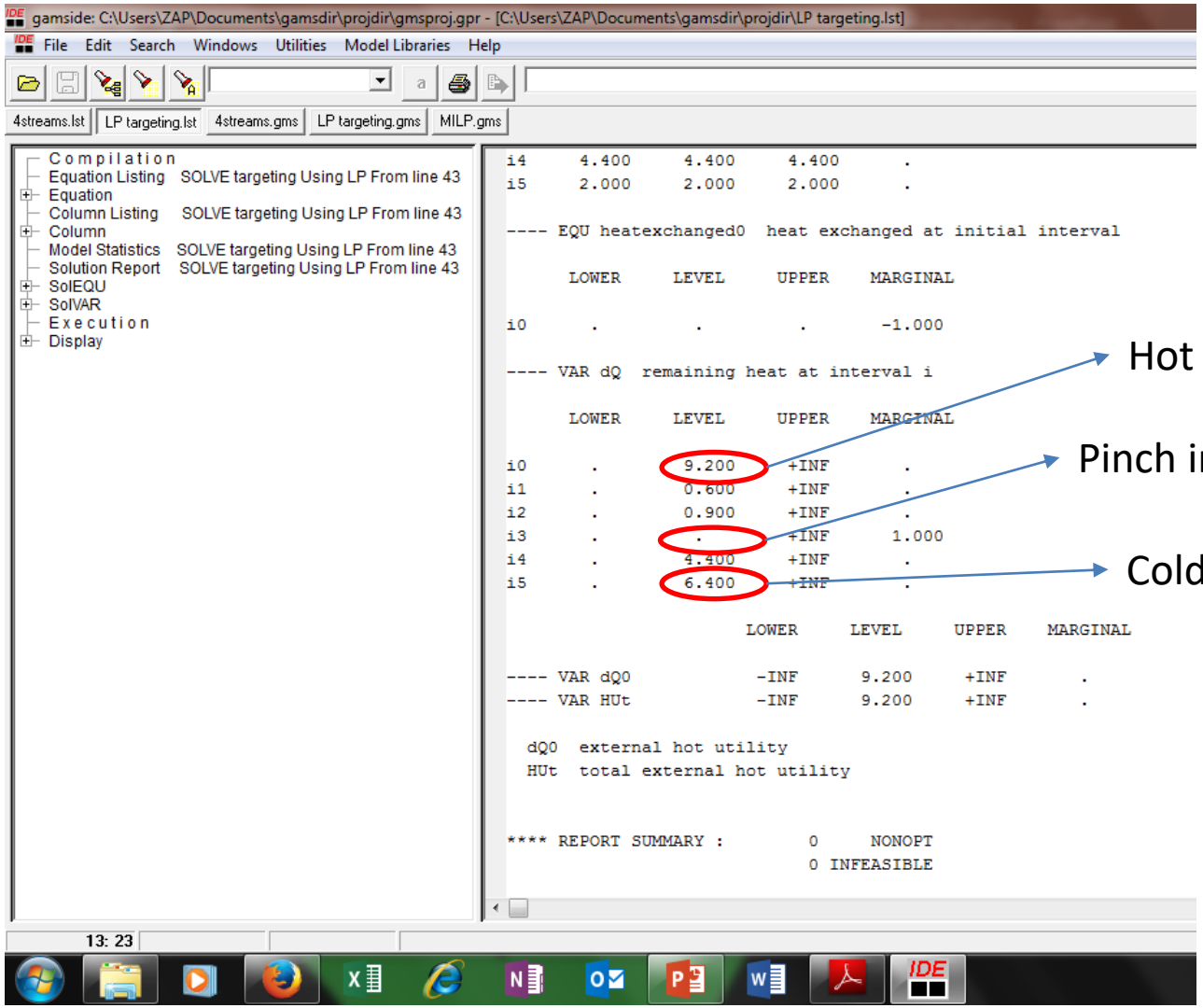
Chemical Engineering
Inspiring Potential·Generating Futures

GAMS MODEL

UNIVERSITI TEKNOLOGI PETRONAS

```
sets
i temperature interval / i0*i5/;

parameters
QH(i) heat available at interval i
         / i0 0
         i1 0
         i2 6.75
         i3 2.25
         i4 17
         i5 4/
QC(i) heat consumed at interval i
         / i0 0
         i1 8.6
         i2 6.45
         i3 3.15
         i4 12.6
         i5 2/;

variables
dQ(i) remaining heat at interval i
dQ0 external hot utility
HUt total external hot utility;

positive variables
dQ;

equations
heattarget     target hot utility
heatexchanged(i)        heat exchanged at interval i
heatexchanged0(i) heat exchanged at initial interval;

heattarget.. HUt =e= dQ0;
heatexchanged(i)$(ord(i) NE 1).. dQ(i) =e= QH(i)+dQ(i-1)-QC(i);
heatexchanged0(i)$(ord(i) EQ 1).. dQ(i) =e= QH(i)+dQ0-QC(i);

model targeting /all/;

option limrow = 5;

solve targeting using lp minimizing HUt;
display dQ.l;
```

RESULTS


gamside: C:\Users\ZAP\Documents\gamsdir\projdir\gmsproj.gpr - [C:\Users\ZAP\Documents\gamsdir\projdir\LP targeting.lst]
File Edit Search Windows Utilities Model Libraries Help
4streams.lst LP targeting.lst 4streams.gms LP targeting.gms MILP.gms
Compilation
Equation Listing SOLVE targeting Using LP From line 43
Equation
Column Listing SOLVE targeting Using LP From line 43
Column
Model Statistics SOLVE targeting Using LP From line 43
Solution Report SOLVE targeting Using LP From line 43
SolEQU
SolVAR
Execution
Display
i4 4.400 4.400 4.400 .
i5 2.000 2.000 2.000 .
---- EQU heatexchanged0 heat exchanged at initial interval
LOWER LEVEL UPPER MARGINAL
i0 . . . -1.000
---- VAR dQ remaining heat at interval i
LOWER LEVEL UPPER MARGINAL
i0 . 9.200 +INF .
i1 . 0.600 +INF .
i2 . 0.900 +INF .
i3 . . +INF 1.000
i4 . 4.400 +INF .
i5 . 6.400 +INF .
LOWER LEVEL UPPER MARGINAL
---- VAR dQ0 -INF 9.200 +INF .
---- VAR HUt -INF 9.200 +INF .
dQ0 external hot utility
HUt total external hot utility
**** REPORT SUMMARY : 0 NONOPT
0 INFEASIBLE
13: 23
Hot utility
Pinch interval
Cold utility

Chemical Engineering
Inspiring Potential · Generating Futures

CLOSURE REVIEW

UNIVERSITI TEKNOLOGI PETRONAS

- Think of energy as a “thing” that is being transferred from high to low temperature

- The same way of thinking in transferring money from rich to poor countries

Chemical Engineering
Inspiring Potential·Generating Futures

COURSE OVERVIEW

UNIVERSITI TEKNOLOGI PETRONAS