Machine Problem

Part 1 and 2

Code:

```matlab
load('Ecoli_core_model.mat');

% Part A
[x,fval]=linprog(-ecoli_obj,[],[],ecoli_S,zeros(72,1),ecoli_lb,ecoli_ub);
actual_fval = -fval

% Part B
obtain ENO and TKT2 locations
[~,ENOloc] = ismember('ENO',ecoli_rxns);
[~,TKT2loc] = ismember('TKT2',ecoli_rxns);

% obtain ENO fvals
ENOlb = ecoli_lb;
ENOub = ecoli_ub;
ENOlb(ENOloc) = 0;
ENOub(ENOloc) = 0;
[ENOx,ENOfval]=linprog(-ecoli_obj,[],[],ecoli_S,zeros(72,1),ENOlb,ENOub);
actual_ENOfval = -ENOfval

% obtain TKT fval after ENO
TKT2lb = ecoli_lb;
TKT2ub = ecoli_ub;

TKT2lb(TKT2loc) = 0;
TKT2ub(TKT2loc) = 0;

[TKT2x,TKT2fval]=linprog(-ecoli_obj,[],[],ecoli_S,zeros(72,1),TKT2lb,TKT2ub);
actual_TKT2fval = -TKT2fval
```

20 points for correct code.
Output:

```matlab
>> Q3
Optimal solution found.
actual_fval =
    0.9166
Optimal solution found.
actual_ENOfval =
    0
Optimal solution found.
actual_TKT2fval =
    0.9078
```

10 points for each correct fitness. Deduct 2 points each for incorrect sign.

Part 3

Any reaction pair on the following page will be accepted. **10 points for a correct pair.**

Two reactions have a greater effect because they can cut off the production of an essential metabolite completely, preventing growth of the bacteria. **10 points for correct explanation.**
GND TALA
GND TKT1
GND TKT2
GND TPI
H2Ot PFK
H2Ot PFL
H2Ot TPI
ICL PPC
MALS PPC
MDH PPC
NADH16PFK
NADH16PFL
NADH16PGI
NADH16TPI
NADTRHD PFK
NADTRHD PGI
NADTRHD TPI
O2t PFK
O2t PGI
O2t PPC
O2t TPI
PDH PFL
PFK PGI
PFK PGL
PFK RPE
PFK TALA
PFK TKT1
PFK TKT2
PGI PGL
PGI RPE
PGI TALA
PGI TKT1
PGI TKT2
PGI TPI
PGL RPE
PGL TALA
PGL TKT1
PGL TKT2
PGL TPI
PPC SUCDi
RPE TALA
RPE TKT1
RPE TKT2
RPE TPI
TALA TKT2
TALA TPI
TKT1 TKT2
TKT1 TPI
TKT2 TPI