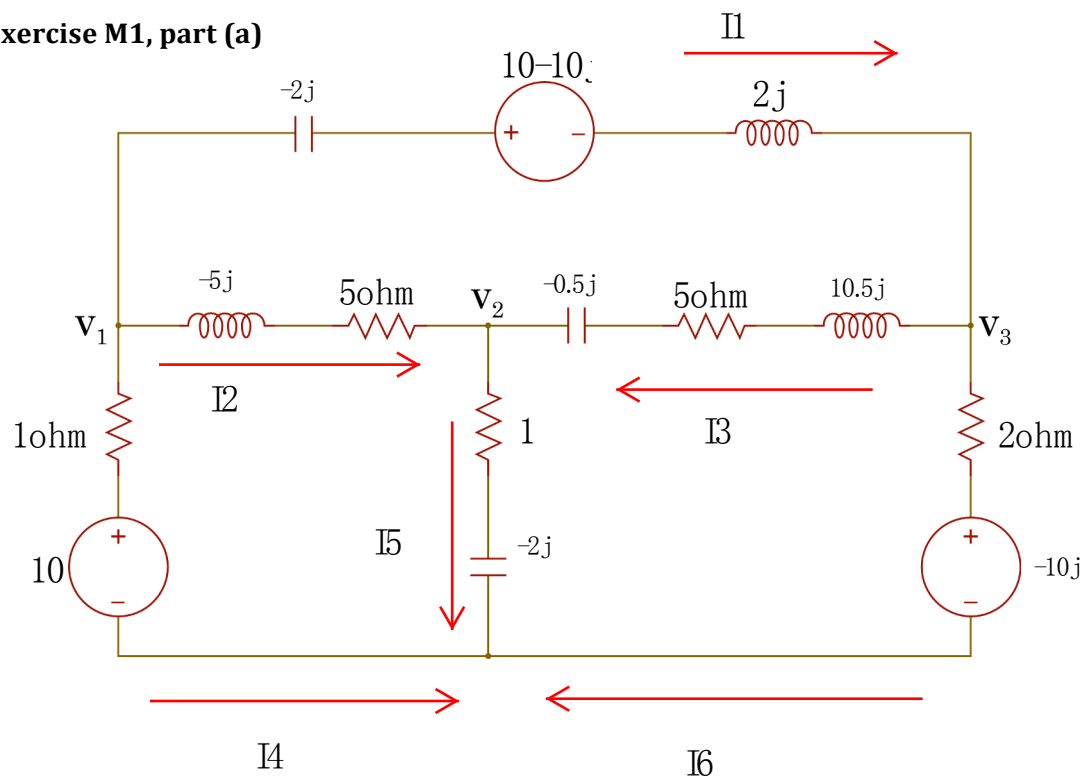**Answer to exercise M1, part (a)**

```matlab
 1 %Xi Kun Zou M1
 2 Z = [ -2j; 2j; 5j; 5; -0.5j; 5; 10.5j; 1; 1; -2j; 2]; %impedances
 3 Zb = [Z(1)+Z(2); Z(3)+Z(4); Z(5)+Z(6)+Z(7); Z(8); Z(9)+Z(10); Z(11)];
 4 %Impedances in each branch I1,I2,I3,I4,I5,I6
 5 V = [10-10j; 10; -10j]; %3 Voltage Sources
 6 %part b
 7 a =  [1 0 -1;
 8       -1/Zb(2) 1/Zb(2)+1/Zb(5)+1/Zb(3) -1/Zb(3);
 9       -1/Zb(4) -1/Zb(5) -1/Zb(6)];
10 b = [V(1); 0; -V(2)/Zb(4)-V(3)/Zb(6)];
11 Vs = a\b
12 %part c
13 I2 = (Vs(1)-Vs(2))/Zb(2);
14 I3 = (Vs(3)-Vs(2))/Zb(3);
15 I4 = (Vs(1)-V(2))/Zb(4);
16 I1 = -I2-I4;
17 I5 = Vs(2)/Zb(5);
18 I6 = (Vs(3)-V(3))/Zb(6);
19 BranchCurrents = [I1; I2; I3; I4; I5; I6] % 6 branch currents
20 %KCL check
21 NodeV1 = sum([I1 I2 I4]);
22 NodeV2 = sum([-I2 I5 -I3]);
23 NodeV3 = sum([I1 -I3 -I6]);
24 Ground = sum([I4 I5 I6]);
25 KCL_Check = [NodeV1;NodeV2;NodeV3;Ground;]
26 %KVL check
27 Mesh1 = -V(1)-I1*Zb(1)-I3*Zb(3)+ I2*Zb(2);
28 Mesh2 = -I5*Zb(5)+ V(2)+I4*Zb(4)-I2*Zb(2);
29 Mesh3 = I5*Zb(5)+I3*Zb(3)-I6*Zb(6)-V(3);
30 KVL_Check = [Mesh1; Mesh2; Mesh3]
31 %part d
32 IV = [I1; I4; I6];
33 IZ = [I1; I1; I2; I2; I3; I3; I3; I4; I5; I5; I6];
34 Power_delivered = (-V).*(conj(IV)/2)
35 Power_absorbed = ((Z).*(abs(IZ).^2)/2)
36 powerbalance = sum(Power_delivered) - sum(Power_absorbed)
```

Trial>> m1

Vs =

   9.1427 - 6.0655i
  -0.5176 - 3.4735i
  -0.8573 + 3.9345i

BranchCurrents =

   0.1504 + 7.2907i
   0.7068 - 1.2252i
   0.5791 + 0.3235i
  -0.8573 - 6.0655i
   1.2859 - 0.9017i
  -0.4286 + 6.9672i

KCL_Check =

   1.0e-15 *

   0.0000 + 0.0000i
  -0.6661 - 0.6106i
   0.2220 + 0.8882i
  -0.8882 - 0.8882i

KVL_Check =

   1.0e-14 *

  -0.1776 + 0.0000i
   0.1776 - 0.0444i
  -0.0222 + 0.0000i

Power_delivered =

  35.7016 +37.2058i
   4.2863 -30.3275i
  34.8362 - 2.1431i

Power_absorbed =

```
    0.0000 -53.1775i
    0.0000 +53.1775i
    0.0000 + 5.0020i
    5.0020 + 0.0000i
    0.0000 - 0.1100i
    1.0999 + 0.0000i
    0.0000 + 2.3097i
   18.7626 + 0.0000i
    1.2333 + 0.0000i
    0.0000 - 2.4666i
   48.7262 + 0.0000i


powerbalance =

   2.8422e-14 + 5.3291e-15i

Trial>>
```