1.a. see solution2
b. Suppose, there are 3 session-blocks S1, S2 and S3. Each one has duration of 10 units. The user traffic-marker pairs for each session is

S1={(u1,m1),(u2,m2)} S2={(u1,m3)(u2,m1)} S3={(u3,m1)}

i) Calculate the uniqueness of the (u1,m1) pair and (u1,m3) pair.
ii) For each of the pairs calculate the persistency if it is possible or justify if calculating persistency is not possible for that pair.

i) P(u1,m1)= 10/30 , P(u2,m1)=10/30 , P(u3,m1)=10/30
Uniqueness (u1,m1)=1-(P(u2,m1)+P(u3,m1))=1-2/3=1/3

P(u1,m3)=10/30 , P(u2,m3)=0, P(u3,m3)=0
Uniqueness (u1,m3)=1-0=1

ii) For (u1,m1) pair as uniqueness<1, persistency in not valid
P(u1)=P(u1,m1)+ P(u1,m2)+ P(u1,m3)=1/3+0+1/3=2/3
Persistency(u1,m3)=1-(P(u1,m1)+P(u1,m2))/P(u1)=1-(1/3+0)/(2/3)=1-1/2=1/2

c. see solution2
d. Suppose, a user u has activity fingerprint F={a1,a2,a3}. There are 3 other users u1, u2 and u3. The lists of services used by each of them are

S1={a1,a2,a3,a4} s2={a2,a3,a4,a5} S3={a1,a2}

Calculate the uniqueness of fingerprint F.

Let k=|F|=3. Among u1, u2 and u3 only |S3|<k whereas |S1|>=k and |S2|>=k
So, S^k ={set of users having at least k activities}={u1,u2}
F^k={set of users having F as a subset of their activities}={u1}
Uniqueness of F=1-$|F^k|/|S^k|$=1-1/2=1/2

2. Fig 1-1 mobility model survey
Random model, Models with Temporal dependency, Models with Spatial dependency, Models with geographic restriction

3. a) In case of MAUI, what are the 3 types of codes which should never be marked as “remoteable”?
1) code that implements the application’s user interface;
2) code that interacts with I/O devices where such interaction only makes sense on the mobile device; and
3) code that interacts with any external component that would be affected by re-execution.

b)
V={J1,J2,J3,J4}
For each vϵV,
E_v^l = Energy to execute it locally, so here E_{J1}^l=10J, E_{J2}^l=15J, E_{J3}^l=20J, E_{J4}^l=5J
T_v^l = Time to execute it locally, so here T_{J1}^l=5s, T_{J2}^l=10s, T_{J3}^l=20s, T_{J4}^l=2s
T_v^r = Time to execute it remotely, so here T_{J1}^r=2s, T_{J2}^r=5s, T_{J3}^r=10s, T_{J4}^r=1s
r_v=1 if marked as remoteable, so here r_{J1}=0, r_{J2}=1, r_{J3}=1, r_{J4}=0
For each edge, (u,v) in call graph where uϵV and vϵV

$B_{u,v}$=Time of state transfer if either of u and v is offloaded , so here $B_{J1,J2}$=2s, $B_{J2,J3}$=3s, $B_{J3,J4}$=5s

$C_{u,v}$=Energy of state transfer if either of u and v is offloaded , so here $C_{J1,J2}$=1J, $C_{J2,J3}$=2J, $C_{J3,J4}$=3J

Formulation of ILP:

Assuming, for vϵV, I_v=0 if it is decided by the maui solver not to offload it and 1 otherwise.

$$\text{maximize} \sum_{v \in V} I_v \times E_v^l - \sum_{(u,v) \in E} |I_u - I_v| \times C_{u,v}$$

$$\text{such that:} \sum_{v \in V} ((1 - I_v) \times T_v^l) + (I_v \times T_v^r))$$

$$+ \sum_{(u,v) \in E} (|I_u - I_v| \times B_{u,v}) \leq L$$

$$\text{and} \quad I_v \leq r_v, \ \forall v \in V$$

Calculate the time and energy spent, if the solver decides to

I) offload none of J2 and J3 and

II) offload both J2 and J3

I) Time=5+10+20+2=37s, Energy=10+15+20+5=50J

II) Time=5+2+(5+10)+5+1 (bracketed part at maui server)=28s
Energy=10+1+3+5=19J