Please write readably and answer in English.
There are three classes of questions: (a) expecting (relatively) short answers, (b) expecting more elaborate answers, and (c) a small design task. The questions are marked accordingly.

Questions:

1. [6p, a] Bundle Protocol bundles contain a dictionary. Explain how this dictionary works, what is it used for and why.

2. [6p, b] a) Sketch the bundle protocol stack and describe the respective layers and their functions.

    b) What is *custody transfer* and which layers are involved in providing it?

3. [6p, b] Describe *all* the communication steps involved in exchanging a message between mobile opportunistic networks created between devices carried by humans.

4. [6p, a] What information is required for defining the edge cost in a deterministic DTN?

5. [6p, b] What are the different possible times to make a routing decision? What are their problems and/or benefits in DTN routing?

6. [6p, a] What is meant by the *transitive property* of probability in PROPHET?

7. [6p, a] What is meant by "key management"? Why is it particularly challenging in DTNs?

8. [12p,c] BitTorrent is a widely used peer-to-peer content distribution protocol. In BitTorrent, A *Torrent* file describes each content item by means of metadata (including its name and size). It also points to a *tracker*, a node that keeps track of the *seed* (i.e., the origin) and of all peers that are currently available in the peer-to-peer overlay and have (chunks of) the file content. The tracker acts as a rendezvous point to help (new) peers find others that carry chunks they are missing. Obviously, the tracker is regularly updated by the peers.

    You want to design a DTNTorrent for peer-to-peer content sharing in mobile opportunistic networks.

    a) What are the weak points of the BitTorrent protocol that make it unsuitable for DTNs?

    b) While the *seed* obviously remains to be the origin of a file to be distributed, how would you define the role of the tracker? Which node(s) would you choose to perform this task?

    c) Sketch a system and simple protocol design that would achieve a BitTorrent-like distribution.

    d) What type of "routing" protocol(s) would you choose and why?

    e) What are the systematic limitations of your proposed system?

    (Note: there are many possible solutions.)