1. What is odometry ?
Odometry is estimation of robot position from the starting point using various motion sensors. Wheel encoder are most common sensor used for odometry.

2. What are the main problems related with odometry ?
Position is calculated by integrating velocity data over time. Therefore, it is subjected to error and sensor readings deviate from actual position with with time. Also, it need resetting every time the sensor is started.

3. Can odometry can be used as the only mean of localization ? Why ?
No. Due to noisy data and integration error, sensor accumulates substantial amount of error with time.

4. What is dead reckoning ?
Process to determine current position of robot based on last position by integrating velocity over time

5. What are the main challenges when applying an Extended Kalman filter ?
We need to model the system accurately otherwise it diverges very quickly because of linearization of nonlinear system. Also, initial state should be known very accurately.

6. Define the SLAM problem with your own words.
The process of mapping an unknown environment around a robot and simultaneously estimating its position in the map is SLAM. The map created are probabilistic in nature are updated as and when new or more accurate information is available via a set of on/off board sensors.

7. How do occupancy grids work ?
Occupancy grid algorithm starts by dividing the interested area into multiple grid each holding a value that represent the probability of the grid being occupied by an object or a wall. The key is to explore the area and calculate those occupancy probability using a range sensor/s like LIDAR/SONAR. Bayesian filtering is used to calculate and review the probabilities.

8. What are the main pros and cons of a Particle Filter for navigation ?
Pros:
More general purpose and unlike EKF, does not depend much on linearity/non-linearity of state space model.
For low dimensional space, it out performs Kalman filter and other traditional approach.

Cons:
Performs poorly for higher dimension space.

9. What are the main challenges in robotics navigation ?

a. Getting correct estimate of robot state using noisy and incorrect sensors
b. Accurate modeling of robot for simulation. Simulation are clearly more easy to work with and provide more insight about the dynamics of system
c. Producing accurate transformation matrices between car's frame and various sensor and camera frame.
d. Producing an accurate map/representation of the environment around the robot.
e. Planning and executing trajectories from point A to point B.
f. Implementing safety condition and recovering from a unanticipated situation.
g. Switching between different states during navigation and avoiding loop like situations.
h. Synchronizing mapping of same space at different point in time, Eg - When car return to starting point after a lap, system should be intelligent enough to acknowledge and handle drift in car's state

10. What is a holomonic robot ? Give examples.
Robots that can directly move in any direction in its space unlike a differential robot that can move only in forward direction and not sideways. Controllability is equal to degree of freedom
Example-
In 2D- robot with omnidirectional wheel
In 3D - Quadrotor