Quiz 4: Multistate Models

Instructions

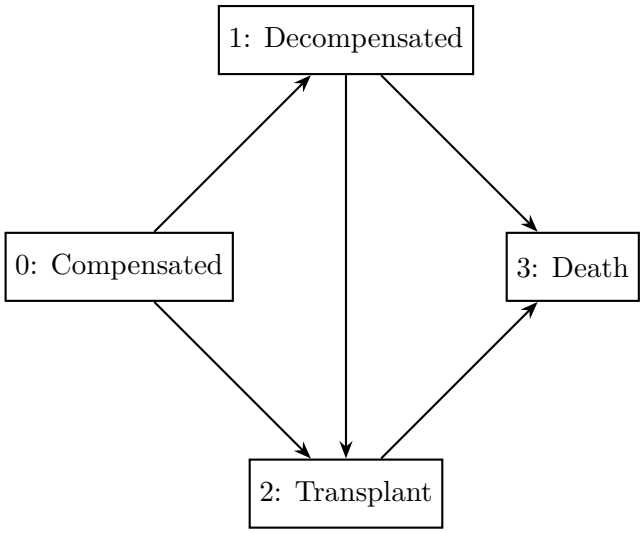
- You have **10 minutes** to complete this quiz.
- Answer all questions concisely.
- Show all work clearly where calculations are required.

Question: Multistate Model for Liver Disease Progression (5 points)

In a study of patients with chronic liver disease, individuals are initially diagnosed with **compensated cirrhosis**, meaning that their liver function is impaired but they have not yet developed major symptoms. Over time, some patients experience disease progression and develop **decompensated cirrhosis**, characterized by clinical events such as ascites, variceal bleeding, or hepatic encephalopathy. At any point, patients may become eligible for a **liver transplant**, either directly from the compensated stage or after decompensation. Finally, patients may **die** after they develop decompensated cirrhosis — either without ever receiving a transplant, or after undergoing a transplant.

(a) (5 points)

Draw a multistate diagram showing the four patient states — compensated cirrhosis, decompensated cirrhosis, liver transplant, and death — and all possible transitions among them.



(b) (5 points)

Answer the following questions:

1. Which state(s) are absorbing? Briefly explain your reasoning.

State 3 (Death) is absorbing because, once a patient dies, no further transitions can occur.

2. Would a *Markov* or a *semi-Markov* model be more appropriate for describing the risk of death *after* liver transplantation? Explain their differences.

A **semi-Markov model** is more appropriate for the transition from transplant to death. The risk of death depends on the **time since transplant**, not just the current state.