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Homework Assignment 2

The assignment is due by Thursday, June 27, 23:59.
Late submissions will be awarded 0 (zero).

1. It's been estimated that if a truck collides with a car, the damage to the car one is $A_C =$ \$4,000. There is no damage to the truck. The probability of a collision is described by $p(s_T, s_C) = (s_T^2 + s_C^2)/100,000$, where s_T is the truck speed and s_C is the car speed, in km/h. The maximum speed the vehicles are capable of is 100 km/h.

   Each driver can take precautions; assume the only feasible precaution is to reduce the speed. The cost of taking precautions by the truck driver is $4 \times (100 - s_T)$, that is the truck driver loses \$4 value for every 1 km/h slowing down. The cost of taking precautions by the truck driver is $3 \times (100 - s_C)$, that is the car driver loses \$3 value for every 1 km/h slowing down.

   a. What are the efficient speeds by each driver? How often do collisions happen (i.e., what is the probability of a collision p) at the efficient speeds?

   b. Suppose the rule is *no liability* = nobody compensates anyone else for the damages, in case of an accident. What speed would the truck driver choose? What speed would the car driver choose? How often do collisions happen (i.e., what is the probability of a collision p) at these chosen speeds?

   c. Suppose the rule is *strict liability* = the truck driver must fully compensate the car owner for the damages no matter how they drive, in case of an accident. What speed would the truck driver choose? What speed would the car driver choose? How often do collisions happen (i.e., what is the probability of a collision p) at these chosen speeds?

   d. Suppose the rule is *shared liability* = the truck driver must compensate the car owner for half of the damages no matter how they drive, in case of an accident. What speed would the truck driver choose? What speed would the car driver choose? How often do collisions happen (i.e., what is the probability of a collision p) at these chosen speeds?

e. If the rule were any other allocation of liability and damages where the truck driver must pay some compensation L_T and the car driver assumes the rest of the damages, $A_C - L_T$?, would the efficient speeds be chosen by both drivers? Explain.

f. What do you conclude from these examples? I.e., can the efficient outcome be achieved by any *ex post* allocation of liability and damages? Explain.

g. Now consider how this could be solved by introducing a negligence rule. Let us pick a *simple negligence* rule = if the truck driver does not exceed the legal speed limit of 50 km/h, the truck driver is not liable for any damages; if the truck driver exceeds the legal speed limit of 50 km/h, the truck driver is fully liable for the damages.

   i. Draw the truck driver's expected full cost (cost of taking precautions + expected liability) as a function of s_T. What speed would the truck driver choose?

   ii. Draw the car driver's expected full losses (cost of taking precautions + expected damages) as a function of s_C if the truck driver is not speeding. What speed would the car driver choose?

   iii. Draw the car driver's expected full losses (cost of taking precautions + expected damages + expected compensation [remember the damages and compensation have opposite signs for the car driver]) as a function of s_C if the truck driver is speeding. What speed would the car driver choose?

   iv. What are the equilibrium s_T and s_C? Explain. Is this outcome efficient?

2. Assume the following happened:

   - One of the stop signs at the intersection of two Coquitlam roads is knocked over on Saturday evening;

   - The city Roads & Transportation Service (responsible for "signs down, missing or vandalized") gets a call to their Engineering Customer Service very early on Sunday morning (so now they know the sign is down) but decides to wait until Monday morning to replace the sign, in order to save $1,250 overtime pay to its road crew;

   - Sunday evening, Mr. Zhang, unaware that the sign is missing, assumes that he has the right-of-way, enters the intersection without slowing, and collides with Mr. Samnani's car;

- The two cars and their occupants suffer damages which total $10,000 ($4,000 to Mr. Zhang and $6,000 to Mr. Samnani);

- At trial, the court accepts the traffic expert testimony that the probability, per day, that such an accident will occur is 20% if there is no stop sign in place and 5% if there is a stop sign.

Will the court (they apply the Hand Rule) find the Roads & Transportation Service negligent? Show your work.

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