Homework 5

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1 Prolog

1.1 Translation to first-order logic:

$Ship(Serenity)$

$Captain(Mal, Serenity)$

$Crewmember(Zoe, Serenity)$
$Crewmember(Wash, Serenity)$
$Crewmember(Kaylee, Serenity)$

$Passenger(Simon, Serenity)$
$Passenger(River, Serenity)$

$Married(Zoe, Wash)$

$\forall x\ \forall y\ \forall z\ \ Ship(x) \land Captain(y, x) \land crewmember(z, x) \Rightarrow Serves(z, y)$

$\forall x\ \forall y\ \forall a\ \ Ship(x) \land Captain(y, x) \land Passenger(a, x) \Rightarrow Protects(y, a)$

$\forall a\ \ Passenger(a, Serenity) \Rightarrow Friends(Kaylee, a)$
$Friends(Mal, Zoe)$

2 HTN Planning Formulation

(Note: All distances are calculated in miles.)

method $Walk(Current\_Location, Desired\_Destination, Max\_Time\_Willing, Max\_Dist\_Walk)$
Task: $Travel(Current\_Location, Desired\_Destination)$
Preconditions: $Max\_Time\_Willing \geq 20{*}dist(Current\_Location, Desired\_Destination)$
$Max\_Distance\_Walk \geq dist(Current\_Location, Desired\_Location)$
Subtasks: $(Travel\_By\_Foot(Desired\_Destination))$

operator $Travel\_By\_Foot(Desired\_Destination)$
Effect: $At(Desired\_Destination)$

method $T(Current\_Location, Desired\_Destination, T\_Map, Street\_Map, Max\_Time\_Willing, Max\_Spending, Max\_Dist\_Walk)$
Task: $Travel(Current\_Location, Desired\_Destination)$
Preconditions: $Max\_Time\_Willing \geq time\_T\_takes(T\_Map, Street\_Map)$,
$Max\_Spending \geq 3, Max\_Dist\_Walk \geq dist\_going\_to\_walk(Street\_map)$
Subtask: $(Take\_T(Desired\_Destination))$

operator $Take\_T(Desired\_Destination)$
Preconditions: $Value(money) \geq 3$
Effects: $At(Desired\_Destination), Value(money) = Value(money) - 3$

method $Lyft(Current\_Location, Desired\_Destination, Max\_Time\_Willing, Max\_Spending)$
Task: $Travel(Current\_Location, Desired\_Destination)$
Preconditions: $Max\_Time\_Willing \geq 2{*}dist(Current\_Location, Desired\_Destination)$,
$Max\_Spending \geq 3{+}\lceil 2{*}dist(Current\_Location, Desired\_Destination)\rceil$
Subtasks: $(Request\_Ride(Pickup\_Location, Desired\_Destination)$,
$\{Lyft\_Ride(Desired\_Destination), No\text{-}show(Pickup\_Location)\})$

operator $Request\_Ride(Pickup\_Location, Desired\_Destination)$
Preconditions: $Value(money) \geq 3{+}\lceil 2{*}dist(Current\_Location, Desired\_Destination)\rceil$
Effect: $Lyft\_Driver\_At(Pickup\_Location)$

operator $Lyft\_Ride(Pickup\_Location, Desired\_Location)$
Preconditions: $At(Pickup\_Location)$
Effects: $At(Desired\_Destination)$,
$value(money) = value(money){-}3{+}\lceil 2{*}dist(Current\_Location, Desired\_Destination)\rceil$

operator $No\text{-}show$(Pickup_Location, Desired_Location)
Preconditions: $\neg At(Pickup\_Location)$
Effects: $value(money) = value(money) - 5$