CS 293 Lab Assignment 11
Due: Oct 28, 2022, 2pm

In this final lab for implementing our super-duper journey planner, we will provide a slightly sophisticated facility that not all planners may provide. This is called Monthly Planning, and is described in detail below.

A passenger needs to travel from a given station A to a set of stations, say B, C and D over a month. On some days in the month, the passenger may have to go from A to B, and on other days, the passenger may have to go from A to D, and so on. However, the passenger doesn't know in advance on which day she has to travel where. So the passenger wishes to buy a monthly ticket that allows her to travel on trains between specific stations on any day of the month, and also transit from one train to another (if needed) at specific transit stations on any day of the month. The cost of a monthly ticket has two components: a monthly train travel cost, and a monthly transit cost. The sum of these two costs eventually becomes the cost of the monthly ticket. Needless to say, the passenger wishes to minimize the overall cost she has to pay for the monthly train travel and transits (if any). We describe below how a monthly train travel cost is computed, and how a monthly transit cost is computed. Your job is to help the passenger plan the monthly travel, so that her monthly ticket cost is minimized.

For purposes of this lab, and to keep things simple, we will assume that the cost of a monthly ticket for travel by ***any*** direct train from station X to station Y is proportional to the time interval (in minutes) between the departure time of the train from station X and its arrival time at station Y. The constant of proportionality is given by a parameter DIRECT_JOURNEY_RATE defined in codes.h. Thus, if a direct journey (by any train) from station X to station Y takes 200 minutes, then the cost of a monthly ticket for this journey is Rs. DIRECT_JOURNEY_RATE * 200. In case a passenger needs to change trains at a station, we must ensure there is a minimum of 15 mins between the arrival time of the incoming train by which the passenger arrives and the departure time of the outgoing train by which she leaves the station. Transit at a station requires use of the station facilities and is therefore charged to the passenger on a monthly basis. However, there are no transit costs if the transit time (i.e. time between arrival of incoming train and departure of outgoing train being taken by the passenger) is less than 60 mins. Otherwise, the monthly cost for transit at ***any*** station is a fixed amount given by a parameter TRANSIT_COST, also defined in codes.h Note that the same station, say Z, may be used as a transit station in a journey from A to B, and also in a journey from A to D. If both of these require a transit time < 60 mins at station Z, then the passenger doesn't pay any monthly transit cost for station Z. However, even if one of these journeys requires a transit time of >= 60 mins at station Z, the passenger must pay a monthly transit cost of TRANSIT_COST for station Z. A similar consideration applies for all stations where the passenger potentially has to change trains in going from A to any of the specified destinations B, C, D.

Given the source station and the set of destination stations the passenger wants to visit over a month, you are required to use the idea of a minimum spanning tree (but with appropriate modifications) find the minimum-cost travel plan for the passenger, where the cost of a travel plan is the sum of all monthly train journey costs and transit costs (in case the

passenger needs to change trains) at stations in the plan. Just like a monthly train ticket requires you to pay a fixed amount upfront regardless of the number of times you actually travel by that train in a month, a monthly transit cost is also an upfront cost that you pay because you may use the transit facilities at a station for 60 mins or more, regardless of whether you use the transit facilities for 60 mins or more.

You must write your code for the function printMonthlyPlan in printMonthlyPlan.cpp Feel free to define any new classes you may want to use in this file. Your final answer must print the plan of the journey from the source station to each of the destination stations separately. Of course, these journeys can share the same segment of a journey. For example, a journey from A to B may be a journey from A to X, followed by a change of trains to a journey from X to B. Similarly, a journey from A to C may be a journey from A to X, followed by a change of trains to a journey from X to B. And, we may even have a journey from A to D that takes the same train as the one that comes from A to X, but then the passenger continues in the same train to D. For each journey from a source to a destination, you must indicate the transit time at each station where there is a change of trains (if any).

You must also print the total cost of the monthly plan, i.e. the sum of all the monthly train journey costs and the monthly transit costs at all stations where a change of trains happens for some journey.

In case there are multiple monthly plans with the same minimum cost, you can print any one of them.

To compile the planner, please use **g++ -g -o planner main.cpp**
To debug, please use **gdb ./planner** on Linux or **lldb ./planner** on Mac

Please submit only printMonthlyPlan.cpp and assumptions.txt in a tar zipped folder named <roll_number>_L11 **Not following the submission instructions strictly may lead to penalty.**