Communication Network Design Lab – Task Submission (Task #2)

Full name	Person code
Mohammadreza Zamani	10869960
Karim Al Wazze	11041528

1. Report for task submission to CND LAB

A. Describe the main objective of the task

Because the objective function is meant to measure performance the way it is defined as the minimization of total wavelength usage across the network. The objective function sum (l_p .* sum(r_cn_lambda, 3)) does this as follows: it takes the common number of link for each route (l_p) and multiplies it by the corresponding linkage (r_cn_lambda) for that particular wavelength. Here, l_p stands for any given route a number of links and performs the role of a weighting parameter, while sum (r_cn_lambda, 3) is the sum of all wavelengths useful on various routes. With this formulation, we first compute the capacity L in terms of the variable q for every route and go ahead and sink this for all demands D and all wavelengths, thereby achieving minimal wavelength allocation for the network architecture. This approach is in conformity with requirements of Task #2 that relates to the optimization of capacity with due consideration to the wavelength continuity limitation.

B. Describe the main changes in the code and report the code modifications (it can also be a screenshot)

1- The 3D decision variable r_cn_lambda keeps track of the route's wavelength usage per order. Its usage is done by assigning a binary (1 or 0) value to it. As a result, the code will designate specific wavelengths for various routes, each of which will be given a single unique wavelength.

```
54        op.addDecisionVariable("r_cn_lambda", isNonBifurcated, new int[]{1, netPlan.getNumberOfRoutes(), W}, 0, 1);
```

2- The total number of wavelengths employed across all paths is minimized by summing the number of paths for links and multiplying t by each path. This method increases overall capacity by minimizing the total number of wavelengths in use.

```
op.setInputParameter("l_p", netPlan.getVectorRouteNumberOfLinks(), "row");
op.setObjectiveFunction("minimize", "sum (l_p .* sum(r_cn_lambda, 3))");
```

3- Every link is to be identified as a lone belonging to a single wavelength and is not permitted to be shared more than once. It compiles all paths over all links avoiding duplication of any wavelength so as to satisfy the continuity of wavelengths.

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```
for (Link e : netPlan.getLinks())
{
    op.setInputParameter("n_e", NetPlan.getIndexes(e.getTraversingRoutes()), "row");
    op.setInputParameter("linkcapacity", e.getCapacity());
    op.addConstraint("sum(r_cn_lambda(n_e, :)) <= linkcapacity");
```

4- This line fetches the overall optimized used wavelengths through the method op.getOptimalCost(). This outcome enables you to populate the table with levels of capacity utilization for each configuration.

```
return "Ok! Total number of wavelengths used in the links: " + op.getOptimalCost();
```

C. Report the main results. For example, in a table as the one shown below

D.

Result for WP

C	K = 1	*K* =2	*K* = 3
20	Not found	Not found	Not found
23	Not found	Not found	272
25	Not found	Not found	270
27	268	268	268
30	268	268	268

Result for vWP

C	K = 1	*K* =2	*K* = 3
20	Not found	Not found	Not found
23	Not found	272	272
25	Not found	270	270
27	268	268	268
30	268	268	268

E. Comment the main takeaways from your results. What is the main message you get from the numerical results? Is it what you expected? If yes, why, if not, why? Motivate your answer.

The optimum value of the objective function, which is the value of the number of

wavelengths used in this case the line op.getOptimalCost() is the end of subject. This line provides the value of the total capacity usage in which all the demands have been satisfied by the cut and number of wavelengths utilized. Seeing these total spectral lines appear in the return statement we therefore get the total wavelength consumption, and it fits perfectly into the requirements of the task to report capacity usage in tension fields set by variable connections C and routing base k.