February 21, 2020

1 First cut implementation

Edge relaxation/conditional hooking: Let p be a vector of ints and A be a matrix of EdgeExt (key, weight, parent).
Analgous to $p["i"] += A["i"] * p["j"]$ for hooking.

```
Algorithm:
  while $p_prev != p$:
    $p_prev = p$
    $p["i"] += A["i"] * p["j"]$

    while $s_prev != p$
      $s_prev = p$
      $p[p[i]] = s_prev$
```

Note $+=$ ensures hooking on roots.

For current mst implementation, $p["i"] += A["i"] * p["j"]$ is computed with the following routine:

```
Edge Relaxation:
  auto q = new Vector<EdgeExt>(n, p->is_sparse, *world, MIN_EDGE);
  (*q)["i"] = Function<int,EdgeExt>([](int p){ return EdgeExt(INT_MAX, INT_MAX,
  Bivar_Function<EdgeExt,int,EdgeExt> fmv([](EdgeExt e, int p){ return EdgeExt(
  fmv.intersect_only=true;
  (*q)["i"] = fmv((*A)["ij"], (*p)["j"]);
  (*p)["i"] += Function<EdgeExt,int>([](EdgeExt e){ return e.parent; })((*q)["i
```

For all i, this routine finds computes $minedge = \min_j A["ij"]$ and sets $p[i] = minedge.parent$. However, our current implementation fails to perform any hooking after the initial step. The nodes are "happy" with their minimum edge and do not want to take any other edge.

Potential fixes: "zeroing out" entries in A to signify that the corresponding edge has already been taken, project matrix to $\#(stars)x\#(stars)$, or enlarge EdgeExt to have an additional boolean parameter *taken*.

We also must consider how to track mst, as p will only contain information about the current forest (ie not where edges originally came from/were going to).

2 Meeting Notes

20-Feb:
Comment after discussion: The other edges will still be taken (similar to connectivity). An example graph of 3 nodes where 0 is connected to 2 with edge weight 10, and 0 is also connected to 1 with edge weight 30. 0 would pick node 1 in the 1st iteration, and 1 would pick 3 "through" 0 in the next iteration. The parent vector can also have a pseudo parent vector which keeps track of the edge each node initially took to get connected. This will essentially capture the MST.