1 Creating Small Learning Plans

Denote by Q the complete set of questions used to assess members. Let $Q^m \subset Q$ be a set of questions for which member m obtained less than a perfect score. Let R be a set of educational resources.

Definition 1. *Resource Alignment A resource alignment is a pair (r, w_r) where $r \in R$ and $w_r : Q \to \mathbb{N}$. $w_r(q)$ denotes how relevant resource r is to question q. If $w_r(q) = 0$ then r has no relevance to q.*

Definition 2. *Question Coverage If $R' \subseteq R$, let $Cov(R') = \{q \mid \exists r \in R', q \in supp(w_r)\}$ where $supp(w_r) = \{q \in Q \mid w_r(q) > 0\}$. Write $Cov(r)$ for $Cov(\{r\})$.*

An educational plan for Q^m is the return value of $CreatePlan(R, Q^m)$. Note that $Q^m \subseteq Cov(plan)$ if and only if $Q^m \subseteq Cov(R)$. Finally, for every $q \in Q^m \cap Cov(R)$, there is a resource r in the plan such that $w_r(q)$ is maximal among $\{w'_r(q) \mid r' \in R\}$.

Algorithm 1 Create a small learning plan

1: **function** CreatePlan(R, Q)
2:     $plan \leftarrow \emptyset$
3:     $set \leftarrow \emptyset$
4:     $Q' \leftarrow Q$
5:     $R' \leftarrow R$
6:     **while** $Q' \neq \emptyset$ **do**
7:         **if** $R' = \emptyset$ **then**
8:             **return** $plan$ $\triangleright$ No more resources to select.
9:         **end if**
10:        $r \leftarrow$ arbitrary element of $\{r' \mid \forall r'' \in R', CW(r') \geq CW(r'')$
11:       $set = CS(r)$
12:       **if** $set = \emptyset$ **then**
13:          **return** $plan$ $\triangleright$ $\forall r \in R', Cov(r) \cap Q' = \emptyset$
14:       **end if**
15:       $Q' \leftarrow Q' \setminus set$
16:       $R' \leftarrow R' \setminus \{r\}$
17:     **end while**
18:     **return** $plan$
19: **end function**

Algorithm 2 Get resource relative covering weight.

1: **function** $\text{CW}(r, R, Q)$ $\triangleright\ r \in R$
2:     $weight \leftarrow 0$
3:     **for all** $q \in supp(r) \cap Q$ **do**
4:        **if** $w_r(q) = Sup\{w'_r(q) \mid r' \in R\}$ **then**
5:           $weight \leftarrow weight + 1$
6:        **end if**
7:     **end for**
8:     **return** $weight$
9: **end function**

Algorithm 3 Get resource relative covering set.

1: **function** $\text{CS}(r, R, Q)$ $\triangleright\ r \in R$
2:     $set \leftarrow \emptyset$
3:     **for all** $q \in supp(r) \cap Q$ **do**
4:        **if** $w_r(q) = Sup\{w'_r(q) \mid r' \in R\}$ **then**
5:           $set \leftarrow set \cup \{q\}$
6:        **end if**
7:     **end for**
8:     **return** set
9: **end function**