Supplementary Material

Weici Hu
wh343@cornell.edu

Peter I. Frazier
pf98@cornell.edu

School of Operations Research & Information Engineering
Cornell University
206 Rhodes Hall
Ithaca, NY 14853, USA

1 Bellman's recursion for $T = \infty$

Below is the Bellmans's recursion on value functions for a single-task system when $T = \infty$:
if $l = U$ and $w_x = 0$:

$$V_x(\alpha_x, \beta_x, w_x, l) = R(\alpha_x, \beta_x); \tag{1a}$$

if $l = U$ and $w_x > 0$:

$$\begin{aligned} & V_x(\alpha_x, \beta_x, w_x, l) \\ =& \frac{\alpha_x}{\alpha_x + \beta_x} V_x(\alpha_x + 1, \beta_x, w_x - 1, l) + \\ & \frac{\beta_x}{\alpha_x + \beta_x} V_x(\alpha_x, \beta_x + 1, w_x - 1, l); \end{aligned} \tag{1b}$$

If $l < U$:

$$\begin{aligned} & V_x(\alpha_x, \beta_x, w_x, l) \\ =& \frac{r}{q_x} \max_{a_{l,x} \in \{0,1\}} \{V_x(\alpha_x, \beta_x, w_x + a_{l,x}, l+1) - \lambda_{l+1} a_{l,x}\} \\ & + \frac{\mu w_x}{q_x} \Big[\frac{\alpha_x}{\alpha_x + \beta_x} V_x(\alpha_x + 1, \beta_x, w_x - 1, l) \\ & \qquad + \frac{\beta_x}{\alpha_x + \beta_x} V_x(\alpha_x, \beta_x + 1, w_x - 1, l) \Big]. \end{aligned}$$

2 Cap on total number of workers per task

Here we set the cap to be 6 and demonstrate it is still a loose cap numerically. We run a simulation with simulated data with 1000 replications for number of workers $K = 10$ and 100, and $U = 2K$and count the number of tasks that uses 0 worker, 1 worker and up to 6 workers. The results are shown in Figure 1. The results show that a task uses at most 4 workers, hence set a cap at 6 does not affect the performance of the index policy.

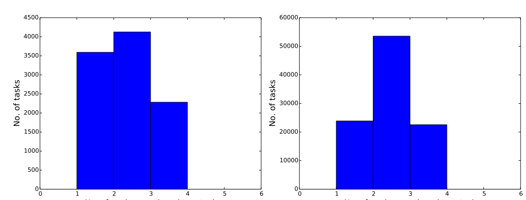

Figure 1: Histogram of number of workers assign to a task