

# IE 473 Material Handling Systems

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## QUIZ # 3:

20/20

⊛ A trolley conveyor is used to transport parts between three production stations. There are 62 carriers equally spaced around the conveyor with 10 ft. separation between carriers. The material flow patterns for the production stations follow:

$$f_1(n) = \{0, -4, 0\}$$

$$f_2(n) = \{3, 2, 3\}$$

$$f_3(n) = \{0, -4, 0\}$$

Determine the carrier capacity?

Period,  $p = 3$ . (1pt)

$f_1$  &  $f_3$  are unloading stations (1pt)

$f_2$  is loading station (1pt)

$k/p = 62/3$  is not an integer ✓ (3pts)

$r = k \bmod p = 62 \bmod 3 = 2 \Rightarrow r/p = 2/3$  is a proper fraction

$p = 3$  is a prime number ✓

$$F_1(n) = (0, -4, 0) + (3, 2, 3) + (0, -4, 0) = (3, -6, 3) \quad (1pt)$$

$$H_i^*(n) = H_i^*(n-1) + F_i(n)$$

Let  $H_1^*(1) = 0$

(2pts)  $H_1^*(3) = H_1^*(1) + F_1(3) = 0 + 3 = 3$

$$H_1^*(5) = H_1^*(2) = H_1^*(3) + F_1(2) = 3 + (-6) = -3$$

$$H_1^*(n) = \{0, -3, 3\} \quad H_{i+1}(n) = H_i(n) - f_i(n)$$

$$H_2^*(n) = \{0, -3, 3\} - \{0, -4, 0\} = \{0, 1, 3\}$$

$$H_3^*(n) = \{0, 1, 3\} - \{3, 2, 3\} = \{-3, -1, 0\}$$
 (2pts)

$$C = \min_{i,n} H_i^*(n) = -3$$
 (2pts)

$$H_i(n) = H_i^*(n) - C$$

$$H_1(n) = \{3, 0, 6\}$$

$$H_2(n) = \{3, 4, 6\}$$

$$H_3(n) = \{0, 2, 3\}$$

(3pts)

$$B = \max_{i,n} H_i(n) = 6$$
 (2pts)

∴ Carrier capacity should be six units. (2pts)