

Question 1

- A- i) Define an AS/RS
ii) Point out the basic components of an AS/RS.
- B- A storage system consists of four storage Carousels each has its own P/D station. Each Carousel has a length of 20 mt and width of 1.0 mt. The velocity of the Carousel is 20 mt/min. The P/D handling time is 0.5 min. Determine the throughput rate of the storage system if the storage and retrieval transactions are equally divided during the shift. Assume bidirectional travel of the Carousel.

Question 2

A storage system consists of five storage Carousels each has its own P/D station. Each Carousel has a length of 15 m and width of 1.0 m. The velocity of the Carousel is 25 m/min. The P/D handling time is 0.5 min. Determine the throughput rate of the storage system if the storage and retrieval transactions are equally divided during the shift. Assume bidirectional travel of the Carousel.

Question 3

Each of 8 aisle AS/RS contains 50 storage components in the length direction and 8 components in the vertical direction. Each component accommodate a standard pallet dimension $x = 1$ m, and $y = 1.25$ m. The height of a unit load $z = 0.75$ m. Determine: -

- The total number of unit loads can be stored in the system.
- The size (length, width, and height) of the storage; assume the allowances and the clearance of the rack from the floor.
- The throughput rate of the AS/RS (loads moved per hour), if an S/R machine is used for each aisle and travels at a horizontal speed of 100 m/min and vertical speed of 30 m/min. The pick and deposit time = 0.35 min. Assume that the number of single command cycles per hour is equal to one half the number of dual command cycles per hour and that the system operates at 80% utilization.

Question 4

Each of 6 aisle AS/RS contains 30 storage slots in the length (y) direction and 8 slots in the vertical direction (z). Each slot accommodates a standard pallet ($x = 1$ m, and $y = 1.25$ m). The height of a unit load $z = 0.75$ m. Determine: -

- The total number of unit loads can be stored in the system.
- The size (length, width, and height) of the storage; assume the allowances and the clearance of the rack from the floor.
- The throughput rate of the AS/RS (loads moved per hour), if a S/R machine is used for each aisle and travels at a horizontal speed of 60 m/min and vertical speed of 40 m/min. The pick and deposit time = 0.35 min. Assume that the number of single command cycles per hour is twice the number of dual command cycles per hour and that the system operates at 80% utilization.

Question 5

- a) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 6000 pallet loads, and the unit pallet size is [1 m x 1 m x 1.25 m].
 - The AS/RS will consist of five aisles with one S/R machine per aisle.
 - Length of the rack is four times its height.
 - The rack structure will be built 1.0 m above floor level.
 - Allowances for width = 0.20 m, length = 0.20 m, and height = 0.25 m.
- b) What is the throughput rate of the designed AS/RS (loads moved per hour)? The following data is given:
- S/R machine travels at a horizontal speed of 80 m/min and vertical speed of 40 m/min.
 - The pick and deposit time = 0.3 min.
 - Assume that the number of dual command cycles per hour is equal to half the number of single command cycles per hour.
 - The system operates at 80% utilization.

Question 6

- A) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 4000 pallet loads, and the unit pallet size is [1 m x 1 m x 1.25 m].
 - The AS/RS will consist of four aisles with one S/R machine per aisle.
 - Length of the rack is five times its height.
 - The rack structure will be built 1.0 m above floor level.
 - Allowances for width = 0.20 m, length = 0.20 m, and height = 0.25 m.
- B) What is the throughput rate of the designed AS/RS (loads moved per hour)? The following data is given:
- S/R machine travels at a horizontal speed of 80 m/min and vertical speed of 40 m/min.
 - The pick and deposit time = 0.4 min.
 - Assume that the number of dual command cycles per hour is equal to half the number of single command cycles per hour.
 - The system operates at 90% utilization.

Question 7

- A) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 2000 pallet loads, and the unit pallet size is [1 m x 1.2 m x 1.2 m].
 - The AS/RS will consist of three aisles with one S/R machine per aisle.
 - Length of the rack is four times its height.
 - The rack structure will be built 0.5 m above floor level.
 - Allowances for width = 0.15 m, length = 0.20 m, and height = 0.25 m.
- B) What is the throughput rate of the designed AS/RS (loads moved per hour)? The following data is given:
- S/R machine travels at a horizontal speed of 100 m/min and vertical speed of 30 m/min.
 - The pick and deposit time = 0.35 min.
 - Assume that the number of single command cycles per hour is equal to one third the number of dual command cycles per hour.
 - The system operates at 80% utilization.

Question 8

- a) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 8000 pallet loads, and the unit pallet size is [1 m x 1 m x 1.25 m].
 - The AS/RS will consist of five aisles with one S/R machine per aisle.
 - Length of the rack is four times its height.
 - The rack structure will be built 1.0 m above floor level.
 - Allowances for width = 0.20 m, length = 0.20 m, and height = 0.25 m.
- b) What is the throughput rate of the designed AS/RS (loads moved per hour)? The following data is given:
- S/R machine travels at a horizontal speed of 80 m/min and vertical speed of 40 m/min.
 - The pick and deposit time = 0.3 min.
 - Assume that the number of dual command cycles per hour is equal to half the number of single command cycles per hour.
 - The system operates at 80% utilization.

Question 9

- a) Given the following data, **determine** the number of aisles, the width, length, and height of the AS/RS for: -
- Total storage capacity is holding 10,000 pallet loads,
 - The ratio of Length: height: width is 10:1:2
 - The unit pallet size is [1 m x 1 m x 0.75 m].
 - The rack structure will be built 0.5 m above floor level and to be lower 0.5 m from ceiling.
 - The rack structure will be built 1.0 m above floor level.
 - Allowances for width = 0.10 m, length = 0.10 m, and height = 0.10 m.
- b) Find the throughput for the designed AS/RS in (a) storing a product. The following data is given:
- S/R machine travels at a horizontal speed of 90 m/min and vertical speed of 40 m/min.
 - The pick and deposit time = 0.35 min.
 - Assume that the number of dual command cycles per hour is equal to half the number of single command cycles per hour.
 - The system operates at 80% utilization.

Question 10

- A) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 3000 pallet loads, and the unit pallet size is [1.25 m x 1.25 m x 1.25 m].
 - The AS/RS will consist of three aisles with one S/R machine per aisle.
 - Number of pallet in the rack length is five times number of pallet in the rack height.
 - The rack structure will be built 1.0 m above floor level.
 - Allowances for width = 0.15 m, length = 0.15 m, and height = 0.25 m.
- B) What is the throughput rate of the designed AS/RS (loads moved per hour)? The following data is given:
- Two items A, B of equal transacted quantity are to be stored. The item A is faster moving than item B.
 - S/R machine Horizontal and vertical travel = 80 m/min.
 - Each pick time and deposit time = 0.35 min.

- The number of single command cycles per hour is equal to half the number of dual command cycles per hour.
- The system operates at 80% utilization.

Question 11

- a) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 9000 pallet loads, and the unit pallet size is [1 m x 1m x 1.25m].
 - The AS/RS will consist of five aisles with one S/R machine per aisle.
 - Length of the rack is four times its height.
 - The rack structure will be built 1.0 m above floor level.
 - Allowances for width = 0.20 m, length=0. 20 m, and height= 0.25 m.
- b) What is the throughput rate of the designed AS/RS (loads moved per hour)? The following data is given:
- Two products (A,B) to be stored with ratio of 2:1
 - S/R machine travels at a horizontal speed of 80 m/min and vertical speed of 40 m/min.
 - The pick and deposit time = 0.3 min.
 - Assume that the number of dual command cycles per hour is equal to half the number of single command cycles per hour.
 - The system operates at 80% utilization.

Question 12

- a) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 10000 pallet loads, and the unit pallet size is [1.5 m x 1m x 1.25m].
 - The AS/RS will consist of five aisles with one S/R machine per aisle.
 - Length of the rack is four times its height.
 - The rack structure will be built 1.0 m above floor level.
 - Allowances for width = 0.20 m, length=0. 20 m, and height= 0.25 m.
- b) Find the throughput for the designed AS/Ra in (b). The following data is given:
- Two products (A,B) to be stored with ratio of 3:1
 - S/R machine travels at a horizontal speed of 80 m/min and vertical speed of 40 m/min.
 - The pick and deposit time = 0.3 min.
 - Assume that the number of dual command cycles per hour is equal to half the number of single command cycles per hour.
 - The system operates at 80% utilization.

Question 13

- a) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 10000 pallet loads, and the unit pallet size is [1.5 m x 1m x 1.25m].
 - The AS/RS will consist of five aisles with one S/R machine per aisle.
 - Length of the rack is four times its height.
 - The rack structure will be built 1.0 m above floor level.
 - Allowances for width = 0.20 m, length=0. 20 m, and height= 0.25 m.
- b) What is the throughput rate of the designed AS/RS (loads moved per hour)? The following data is given:
- Two products (A,B) to be stored with ratio of 3:1

- S/R machine travels at a horizontal speed of 80 m/min and vertical speed of 40 m/min.
- The pick and deposit time = 0.3 min.
- Assume that the number of dual command cycles per hour is equal to half the number of single command cycles per hour.
- The system operates at 80% utilization.

Question 14

- a) Given the following data, **determine** the number of aisles, the width, length, and height of the AS/RS.
- Storage capacity is 3000 pallet loads
 - The ratio of Length: width: height is 6:1:1
 - The unit pallet size is [1.25mx1.25mx1.25m]
 - The rack structure will be built 0.5m above floor level and to be lower 0.5m from ceiling.
 - Allowances for width = 0.25 m, length=0.25 m, and height= 0.25 m.
- b) Given the following; what is the throughput rate of the designed AS/RS (loads moved per hour)?
- Two items A, B of equal transacted quantity are to be stored. The item A is faster moving than item B.
 - S/R machine Horizontal and vertical travel = 80 min.
 - Each pick and deposit time = 0.35 min.
 - Assume that the number of dual command cycles per hour is equal to half the number of single command cycles per hour.
 - The system operates at 80% utilization.

Question 15

- A) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 4000 pallet loads, and the unit pallet size is [1.25mx1.25mx1.25m].
 - The AS/RS will consist of four aisles with one S/R machine per aisle.
 - Number of pallet in the rack length is five times number of pallet in the rack height.
 - The rack structure will be built 1.0 m above floor level.
 - Allowances for width = 0.15 m, length=0.15 m, and height= 0.25 m.
- B) What is the throughput rate of the designed AS/RS (loads moved per hour)? The following data is given:
- Two items A, B of equal transacted quantity are to be stored. The item A is faster moving than item B.
 - S/R machine Horizontal and vertical travel = 80 m/min.
 - Each pick time and deposit time = 0.35 min.
 - The number of single command cycles per hour is equal to half the number of dual command cycles per hour.
 - The system operates at 80% utilization.

Question 16

- a) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 6000 pallet loads, and the unit pallet size is [1.5 m x 1 m x 1.25 m].
 - The AS/RS will consist of five aisles with one S/R machine per aisle.
 - Length of the rack is six times its height.
 - The rack structure will be built 1.0 m above floor level.
 - Allowances for width = 0.20 m, length = 0.20 m, and height = 0.25 m.
- b) Find the throughput for the designed AS/RS in (a). The following data is given:
- Two products (A, B) to be stored with ratio of 2:1
 - Product (A) is faster move than product (B) and the number of cycles of (A) is twice the number of cycles of product (B)
 - S/R machine travels at a horizontal speed of 80 m/min and vertical speed of 40 m/min.
 - The pick and deposit time = 0.3 min.
 - Assume that the number of dual command cycles per hour is equal to half the number of single command cycles per hour.
 - The system operates at 80% utilization.

Question 18

- A) Determine the width, length, and height of the AS/RS for the following data: -
- Storage capacity is 6000 pallet loads, and the unit pallet size is [1.1 m x 1.1 m x 1.25 m].
 - The AS/RS will consist of four aisles with one S/R machine per aisle.
 - Number of pallet in the rack length is six times the number of pallet in the rack height.
 - The rack structure will be built 0.5 m above floor level.
 - Allowances for width = 0.1 m, length = 0.1 m, and height = 0.15 m.
- B) What is the throughput rate of the designed AS/RS (loads moved per hour)? The following data is given:
- Two items A, B are to be stored. The item B is faster moving than item A, the quantity of A stored is double the quantity of B, and the transaction quantity of A is three times the quantity of B.
 - S/R machine Horizontal and vertical travel = 40 m/min.
 - Each pick time and deposit time = 0.35 min.
 - The number of single command cycles per hour is equal to half the number of dual command cycles per hour.
 - The system operates at 90% utilization.