**Operating Systems Lab 2**

Rutger Yager

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Grade Option A

**C Option Code**

**Semaphore.ads**

package Semaphore is

protected type Counting\_Semaphore(Start\_Count: Integer := 1) is

entry Secure;

procedure Release;

function Count return Integer;

private

Current\_Count: Integer := Start\_Count;

end Counting\_Semaphore;

end Semaphore;

**Semaphore.adb**

package body Semaphore is

protected body Counting\_Semaphore is

entry Secure when Current\_Count > 0 is

begin

Current\_Count := Current\_Count - 1;

end Secure;

procedure Release is

begin

Current\_Count := Current\_Count + 1;

end Release;

function Count return Integer is

begin

return Current\_Count;

end Count;

end Counting\_Semaphore;

end Semaphore;

**Coption.adb**

with Ada.Text\_IO, Ada.Calendar, Ada.Numerics.Float\_Random, Semaphore;

use Ada.Text\_IO, Ada.Calendar, Ada.Numerics.Float\_Random, Semaphore;

procedure Coption is

package Duration\_IO is new Ada.Text\_IO.Fixed\_IO(duration); use Duration\_IO;

package integerIO is new Ada.Text\_IO.Integer\_IO(integer); use integerIO;

randNum: Generator;

OfficerSemaphore : Counting\_Semaphore(2); --Controls number of ships allowed to land at once

OfficerMutex : Counting\_Semaphore; --Allows for mutual exclusion when picking a landing officer to use.

type ShuttleName is

(Enterprise,

Atlantis,

Challenger,

Ranger,

Nemesis,

Titan,

Hyperion,

Xwing,

Elysium,

Serenity);

package ShuttleNameIO is new Ada.Text\_IO.Enumeration\_IO(ShuttleName);

use ShuttleNameIO;

task type Spaceship is

entry Assign(N : in ShuttleName);

end Spaceship;

task type LandingOfficer is

entry PermissionToLand (N : in ShuttleName);

entry CallTheBall (N : in ShuttleName);

entry TouchDown (N: in ShuttleName);

end LandingOfficer;

LandingOfficerReserve : array (1..2) of Boolean := (others => False);

LandingOfficerArray : array (1..2) of LandingOfficer; -- 2 officers

SpaceshipArray : array (1..10) of Spaceship; -- 10 ships

task body Spaceship is

initiateLandingSequence: Duration;

LandingComplete: Duration;

LandingOfficerNumber : Integer;

Name : ShuttleName;

begin

accept Assign (N : in ShuttleName) do

Name := N;

end Assign;

for I in 1..5 loop

delay Duration(Random(RandNum) \* 15.0); --Crew performing mission.

OfficerSemaphore.Secure; --Secure position in landing queue

OfficerMutex.Secure; --Secure Landing Officer to use

OfficerLoop:

for I in Integer range LandingOfficerReserve'Range loop

if LandingOfficerReserve(I) = False then

LandingOfficerNumber := I;

LandingOfficerReserve(I) := True;

exit OfficerLoop;

end if;

end loop OfficerLoop;

put(Name); put(" reserved Landing Officer #"); put(LandingOfficerNumber, 1); put("."); new\_line;

OfficerMutex.Release;

put(Name); put(" entering its critical section."); new\_line(2);

initiateLandingSequence:= seconds(clock);

LandingOfficerArray(LandingOfficerNumber).PermissionToLand(Name);

LandingOfficerArray(LandingOfficerNumber).CallTheBall(Name);

delay Duration(Random(randNum) \* 3.0); -- line up shuttle with mother ship

LandingOfficerArray(LandingOfficerNumber).TouchDown(Name);

landingComplete := seconds(clock);

put(Name); put(" docked in "); put( landingComplete - initiateLandingSequence, 2 );

put(" seconds." ); new\_line;

put(Name); put(" is leaving its critical section. Obtain new crew and start next mission.");

New\_Line(2);

OfficerMutex.Secure; --Release Landing Officer

LandingOfficerReserve(LandingOfficerNumber) := False;

put("Landing Officer #"); put(LandingOfficerNumber, 1); put(" is now free for use."); new\_line;

OfficerMutex.Release;

put(Name); put(" has taken off!"); new\_line;

OfficerSemaphore.Release; -- Free position in landing queue

end loop;

end Spaceship;

task body LandingOfficer is

begin

loop

accept PermissionToLand (N : in ShuttleName) do

delay Duration(Random(RandNum) \* 5.0);

put(N); put(" is granted permission to land."); new\_line;

end PermissionToLand;

accept CallTheBall (N : in ShuttleName) do

delay Duration(Random(RandNum) \* 5.0);

put(N); put(" call the ball!"); new\_line;

end CallTheBall;

accept TouchDown (N : in ShuttleName) do

Put(N); Put(" , permission granted for final approach."); New\_Line;

delay Duration(Random(RandNum) \* 10.0);

end Touchdown;

end loop;

end LandingOfficer;

begin

Put("Shuttle operations are authorized."); New\_Line;

SpaceshipArray(1).Assign(Enterprise);

SpaceshipArray(2).Assign(Atlantis);

SpaceshipArray(3).Assign(Challenger);

SpaceshipArray(4).Assign(Ranger);

SpaceshipArray(5).Assign(Nemesis);

SpaceshipArray(6).Assign(Titan);

SpaceshipArray(7).Assign(Hyperion);

SpaceshipArray(8).Assign(Xwing);

SpaceshipArray(9).Assign(Elysium);

SpaceshipArray(10).Assign(Serenity);

end Coption;

**C Option Output**

Shuttle operations are authorized.

CHALLENGER reserved Landing Officer #1.

CHALLENGER entering its critical section.

SERENITY reserved Landing Officer #2.

SERENITY entering its critical section.

CHALLENGER is granted permission to land.

SERENITY is granted permission to land.

SERENITY call the ball!

CHALLENGER call the ball!

CHALLENGER , permission granted for final approach.

CHALLENGER docked in 7.269487770 seconds.

CHALLENGER is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

CHALLENGER has taken off!

XWING reserved Landing Officer #1.

XWING entering its critical section.

SERENITY , permission granted for final approach.

XWING is granted permission to land.

SERENITY docked in 13.631136717 seconds.

SERENITY is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

SERENITY has taken off!

ATLANTIS reserved Landing Officer #2.

ATLANTIS entering its critical section.

XWING call the ball!

ATLANTIS is granted permission to land.

XWING , permission granted for final approach.

ATLANTIS call the ball!

ATLANTIS , permission granted for final approach.

XWING docked in 18.819362520 seconds.

XWING is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

XWING has taken off!

HYPERION reserved Landing Officer #1.

HYPERION entering its critical section.

ATLANTIS docked in 15.126599237 seconds.

ATLANTIS is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

ATLANTIS has taken off!

TITAN reserved Landing Officer #2.

TITAN entering its critical section.

TITAN is granted permission to land.

HYPERION is granted permission to land.

TITAN call the ball!

HYPERION call the ball!

TITAN , permission granted for final approach.

HYPERION , permission granted for final approach.

TITAN docked in 7.751057135 seconds.

TITAN is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

TITAN has taken off!

NEMESIS reserved Landing Officer #2.

NEMESIS entering its critical section.

NEMESIS is granted permission to land.

HYPERION docked in 13.583657966 seconds.

HYPERION is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

HYPERION has taken off!

CHALLENGER reserved Landing Officer #1.

CHALLENGER entering its critical section.

NEMESIS call the ball!

CHALLENGER is granted permission to land.

CHALLENGER call the ball!

NEMESIS , permission granted for final approach.

CHALLENGER , permission granted for final approach.

CHALLENGER docked in 7.392094791 seconds.

CHALLENGER is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

CHALLENGER has taken off!

ENTERPRISE reserved Landing Officer #1.

ENTERPRISE entering its critical section.

NEMESIS docked in 12.481329256 seconds.

NEMESIS is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

NEMESIS has taken off!

RANGER reserved Landing Officer #2.

RANGER entering its critical section.

RANGER is granted permission to land.

ENTERPRISE is granted permission to land.

RANGER call the ball!

ENTERPRISE call the ball!

RANGER , permission granted for final approach.

ENTERPRISE , permission granted for final approach.

RANGER docked in 5.177509366 seconds.

RANGER is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

RANGER has taken off!

ELYSIUM reserved Landing Officer #2.

ELYSIUM entering its critical section.

ENTERPRISE docked in 9.691939055 seconds.

ENTERPRISE is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

ENTERPRISE has taken off!

SERENITY reserved Landing Officer #1.

SERENITY entering its critical section.

SERENITY is granted permission to land.

ELYSIUM is granted permission to land.

SERENITY call the ball!

ELYSIUM call the ball!

SERENITY , permission granted for final approach.

SERENITY docked in 5.214515574 seconds.

SERENITY is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

SERENITY has taken off!

XWING reserved Landing Officer #1.

XWING entering its critical section.

XWING is granted permission to land.

ELYSIUM , permission granted for final approach.

XWING call the ball!

XWING , permission granted for final approach.

XWING docked in 4.941761156 seconds.

XWING is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

XWING has taken off!

ATLANTIS reserved Landing Officer #1.

ATLANTIS entering its critical section.

ATLANTIS is granted permission to land.

ELYSIUM docked in 15.714156866 seconds.

ELYSIUM is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

ELYSIUM has taken off!

TITAN reserved Landing Officer #2.

TITAN entering its critical section.

ATLANTIS call the ball!

ATLANTIS , permission granted for final approach.

ATLANTIS docked in 6.176141762 seconds.

ATLANTIS is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

ATLANTIS has taken off!

NEMESIS reserved Landing Officer #1.

NEMESIS entering its critical section.

TITAN is granted permission to land.

NEMESIS is granted permission to land.

TITAN call the ball!

NEMESIS call the ball!

TITAN , permission granted for final approach.

NEMESIS , permission granted for final approach.

TITAN docked in 15.542715423 seconds.

TITAN is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

TITAN has taken off!

CHALLENGER reserved Landing Officer #2.

CHALLENGER entering its critical section.

CHALLENGER is granted permission to land.

CHALLENGER call the ball!

NEMESIS docked in 13.818226295 seconds.

NEMESIS is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

NEMESIS has taken off!

HYPERION reserved Landing Officer #1.

HYPERION entering its critical section.

CHALLENGER , permission granted for final approach.

HYPERION is granted permission to land.

HYPERION call the ball!

HYPERION , permission granted for final approach.

CHALLENGER docked in 11.348020933 seconds.

CHALLENGER is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

CHALLENGER has taken off!

RANGER reserved Landing Officer #2.

RANGER entering its critical section.

RANGER is granted permission to land.

HYPERION docked in 13.182400609 seconds.

HYPERION is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

HYPERION has taken off!

ENTERPRISE reserved Landing Officer #1.

ENTERPRISE entering its critical section.

RANGER call the ball!

ENTERPRISE is granted permission to land.

RANGER , permission granted for final approach.

RANGER docked in 7.758274090 seconds.

RANGER is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

RANGER has taken off!

SERENITY reserved Landing Officer #2.

SERENITY entering its critical section.

ENTERPRISE call the ball!

SERENITY is granted permission to land.

ENTERPRISE , permission granted for final approach.

SERENITY call the ball!

ENTERPRISE docked in 9.729334094 seconds.

ENTERPRISE is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

ENTERPRISE has taken off!

XWING reserved Landing Officer #1.

XWING entering its critical section.

SERENITY , permission granted for final approach.

XWING is granted permission to land.

XWING call the ball!

XWING , permission granted for final approach.

SERENITY docked in 15.064369632 seconds.

SERENITY is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

SERENITY has taken off!

ATLANTIS reserved Landing Officer #2.

ATLANTIS entering its critical section.

ATLANTIS is granted permission to land.

ATLANTIS call the ball!

XWING docked in 16.199517337 seconds.

XWING is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

XWING has taken off!

ELYSIUM reserved Landing Officer #1.

ELYSIUM entering its critical section.

ATLANTIS , permission granted for final approach.

ELYSIUM is granted permission to land.

ELYSIUM call the ball!

ELYSIUM , permission granted for final approach.

ELYSIUM docked in 11.451285050 seconds.

ELYSIUM is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

ELYSIUM has taken off!

TITAN reserved Landing Officer #1.

TITAN entering its critical section.

ATLANTIS docked in 17.926775433 seconds.

ATLANTIS is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

ATLANTIS has taken off!

NEMESIS reserved Landing Officer #2.

NEMESIS entering its critical section.

TITAN is granted permission to land.

NEMESIS is granted permission to land.

TITAN call the ball!

TITAN , permission granted for final approach.

NEMESIS call the ball!

TITAN docked in 7.484211148 seconds.

TITAN is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

TITAN has taken off!

CHALLENGER reserved Landing Officer #1.

CHALLENGER entering its critical section.

CHALLENGER is granted permission to land.

NEMESIS , permission granted for final approach.

CHALLENGER call the ball!

NEMESIS docked in 14.663361406 seconds.

NEMESIS is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

NEMESIS has taken off!

HYPERION reserved Landing Officer #2.

HYPERION entering its critical section.

CHALLENGER , permission granted for final approach.

HYPERION is granted permission to land.

CHALLENGER docked in 12.078375709 seconds.

CHALLENGER is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

CHALLENGER has taken off!

RANGER reserved Landing Officer #1.

RANGER entering its critical section.

HYPERION call the ball!

RANGER is granted permission to land.

HYPERION , permission granted for final approach.

RANGER call the ball!

RANGER , permission granted for final approach.

HYPERION docked in 14.968628936 seconds.

HYPERION is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

HYPERION has taken off!

ENTERPRISE reserved Landing Officer #2.

ENTERPRISE entering its critical section.

RANGER docked in 12.347403925 seconds.

RANGER is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

RANGER has taken off!

XWING reserved Landing Officer #1.

XWING entering its critical section.

ENTERPRISE is granted permission to land.

ENTERPRISE call the ball!

XWING is granted permission to land.

ENTERPRISE , permission granted for final approach.

XWING call the ball!

XWING , permission granted for final approach.

XWING docked in 10.201195482 seconds.

XWING is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

XWING has taken off!

SERENITY reserved Landing Officer #1.

SERENITY entering its critical section.

ENTERPRISE docked in 12.469387826 seconds.

ENTERPRISE is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

ENTERPRISE has taken off!

ELYSIUM reserved Landing Officer #2.

ELYSIUM entering its critical section.

SERENITY is granted permission to land.

ELYSIUM is granted permission to land.

ELYSIUM call the ball!

SERENITY call the ball!

SERENITY , permission granted for final approach.

ELYSIUM , permission granted for final approach.

SERENITY docked in 14.977575841 seconds.

SERENITY is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

SERENITY has taken off!

ATLANTIS reserved Landing Officer #1.

ATLANTIS entering its critical section.

ELYSIUM docked in 17.525817848 seconds.

ELYSIUM is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

ELYSIUM has taken off!

TITAN reserved Landing Officer #2.

TITAN entering its critical section.

ATLANTIS is granted permission to land.

TITAN is granted permission to land.

ATLANTIS call the ball!

ATLANTIS , permission granted for final approach.

TITAN call the ball!

TITAN , permission granted for final approach.

TITAN docked in 12.106255732 seconds.

TITAN is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

TITAN has taken off!

NEMESIS reserved Landing Officer #2.

NEMESIS entering its critical section.

ATLANTIS docked in 18.022548434 seconds.

ATLANTIS is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

ATLANTIS has taken off!

CHALLENGER reserved Landing Officer #1.

CHALLENGER entering its critical section.

NEMESIS is granted permission to land.

CHALLENGER is granted permission to land.

NEMESIS call the ball!

NEMESIS , permission granted for final approach.

CHALLENGER call the ball!

CHALLENGER , permission granted for final approach.

CHALLENGER docked in 11.392522040 seconds.

CHALLENGER is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

CHALLENGER has taken off!

RANGER reserved Landing Officer #1.

RANGER entering its critical section.

NEMESIS docked in 15.251301174 seconds.

NEMESIS is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

NEMESIS has taken off!

HYPERION reserved Landing Officer #2.

HYPERION entering its critical section.

RANGER is granted permission to land.

RANGER call the ball!

RANGER , permission granted for final approach.

HYPERION is granted permission to land.

HYPERION call the ball!

RANGER docked in 7.921982272 seconds.

RANGER is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

RANGER has taken off!

ENTERPRISE reserved Landing Officer #1.

ENTERPRISE entering its critical section.

HYPERION , permission granted for final approach.

ENTERPRISE is granted permission to land.

HYPERION docked in 9.398570754 seconds.

HYPERION is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

HYPERION has taken off!

XWING reserved Landing Officer #2.

XWING entering its critical section.

ENTERPRISE call the ball!

ENTERPRISE , permission granted for final approach.

XWING is granted permission to land.

XWING call the ball!

ENTERPRISE docked in 7.901085789 seconds.

ENTERPRISE is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

ENTERPRISE has taken off!

ELYSIUM reserved Landing Officer #1.

ELYSIUM entering its critical section.

XWING , permission granted for final approach.

ELYSIUM is granted permission to land.

ELYSIUM call the ball!

XWING docked in 14.702122594 seconds.

XWING is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

XWING has taken off!

SERENITY reserved Landing Officer #2.

SERENITY entering its critical section.

ELYSIUM , permission granted for final approach.

SERENITY is granted permission to land.

SERENITY call the ball!

SERENITY , permission granted for final approach.

ELYSIUM docked in 15.100527163 seconds.

ELYSIUM is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

ELYSIUM has taken off!

TITAN reserved Landing Officer #1.

TITAN entering its critical section.

TITAN is granted permission to land.

SERENITY docked in 10.490380354 seconds.

SERENITY is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

SERENITY has taken off!

ATLANTIS reserved Landing Officer #2.

ATLANTIS entering its critical section.

TITAN call the ball!

ATLANTIS is granted permission to land.

TITAN , permission granted for final approach.

ATLANTIS call the ball!

ATLANTIS , permission granted for final approach.

TITAN docked in 13.027407080 seconds.

TITAN is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

TITAN has taken off!

NEMESIS reserved Landing Officer #1.

NEMESIS entering its critical section.

NEMESIS is granted permission to land.

NEMESIS call the ball!

NEMESIS , permission granted for final approach.

ATLANTIS docked in 12.768306578 seconds.

ATLANTIS is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

ATLANTIS has taken off!

RANGER reserved Landing Officer #2.

RANGER entering its critical section.

RANGER is granted permission to land.

RANGER call the ball!

RANGER , permission granted for final approach.

NEMESIS docked in 11.094219423 seconds.

NEMESIS is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

NEMESIS has taken off!

HYPERION reserved Landing Officer #1.

HYPERION entering its critical section.

HYPERION is granted permission to land.

HYPERION call the ball!

RANGER docked in 12.541468601 seconds.

RANGER is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

RANGER has taken off!

ENTERPRISE reserved Landing Officer #2.

ENTERPRISE entering its critical section.

HYPERION , permission granted for final approach.

ENTERPRISE is granted permission to land.

HYPERION docked in 8.407638149 seconds.

HYPERION is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

HYPERION has taken off!

ELYSIUM reserved Landing Officer #1.

ELYSIUM entering its critical section.

ENTERPRISE call the ball!

ENTERPRISE , permission granted for final approach.

ELYSIUM is granted permission to land.

ELYSIUM call the ball!

ELYSIUM , permission granted for final approach.

ENTERPRISE docked in 11.788537450 seconds.

ENTERPRISE is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

ENTERPRISE has taken off!

ELYSIUM docked in 15.173150148 seconds.

ELYSIUM is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

ELYSIUM has taken off!

**B Option Code**

**Semaphore.ads –** See C option code

**Semaphore.adb –** See C option code

**Boption.adb**

with Ada.Text\_IO, Ada.Calendar, Ada.Numerics.Float\_Random, Semaphore;

use Ada.Text\_IO, Ada.Calendar, Ada.Numerics.Float\_Random, Semaphore;

procedure Boption is

package Duration\_IO is new Ada.Text\_IO.Fixed\_IO(duration); use Duration\_IO;

package integerIO is new Ada.Text\_IO.Integer\_IO(integer); use integerIO;

randNum: Generator;

ShipCount : Integer;

OfficerCount : Integer;

begin

Put("Enter # of Ships: "); Get(ShipCount);

Put("Enter # of Officers: "); Get(OfficerCount);

Put("Creating "); Put(ShipCount); Put(" ships and "); Put(OfficerCount); Put(" officers..."); New\_Line;

declare

OfficerSemaphore : Counting\_Semaphore(OfficerCount); --Controls number of ships allowed to land at once

OfficerMutex : Counting\_Semaphore; --Allows for mutual exclusion when picking a landing officer to use.

task type Spaceship is

entry Assign(ShuttleId : in Integer);

end Spaceship;

task type LandingOfficer is

entry PermissionToLand (ShuttleId : in Integer);

entry CallTheBall (ShuttleId : in Integer);

entry TouchDown (ShuttleId: in Integer);

end LandingOfficer;

LandingOfficerReserve : array (1..OfficerCount) of Boolean := (others => False);

LandingOfficerArray : array (1..OfficerCount) of LandingOfficer;

SpaceshipArray : array (1..ShipCount) of Spaceship;

task body Spaceship is

initiateLandingSequence: Duration;

LandingComplete: Duration;

LandingOfficerNumber : Integer;

ID : Integer;

begin

accept Assign (ShuttleId : in Integer) do

ID := ShuttleId;

end Assign;

for I in 1..5 loop

delay Duration(Random(RandNum) \* 15.0); --Crew performing mission.

OfficerSemaphore.Secure; --Secure position in landing queue

OfficerMutex.Secure; --Secure Landing Officer to use

OfficerLoop:

for I in Integer range LandingOfficerReserve'Range loop

if LandingOfficerReserve(I) = False then

LandingOfficerNumber := I;

LandingOfficerReserve(I) := True;

exit OfficerLoop;

end if;

end loop OfficerLoop;

put("Shuttle #"); put(ID, 2); put(" reserved Landing Officer #"); put(LandingOfficerNumber, 1); put("."); new\_line;

OfficerMutex.Release;

put("Shuttle #"); put(ID, 2); put(" entering its critical section."); new\_line(2);

initiateLandingSequence:= seconds(clock);

LandingOfficerArray(LandingOfficerNumber).PermissionToLand(ID);

LandingOfficerArray(LandingOfficerNumber).CallTheBall(ID);

delay Duration(Random(randNum) \* 3.0); -- line up shuttle with mother ship

LandingOfficerArray(LandingOfficerNumber).TouchDown(ID);

landingComplete := seconds(clock);

put("Shuttle #"); put(ID, 2); put(" docked in "); put( landingComplete - initiateLandingSequence, 2 );

put(" seconds." ); new\_line;

put("Shuttle #"); put(ID, 2); put(" is leaving its critical section. Obtain new crew and start next mission.");

New\_Line(2);

OfficerMutex.Secure; --Release Landing Officer

LandingOfficerReserve(LandingOfficerNumber) := False;

put("Landing Officer #"); put(LandingOfficerNumber, 1); put(" is now free for use."); new\_line;

OfficerMutex.Release;

put("Shuttle #"); put(ID, 2); put(" has taken off!"); new\_line;

OfficerSemaphore.Release; -- Free position in landing queue

end loop;

end Spaceship;

task body LandingOfficer is

begin

loop

accept PermissionToLand (ShuttleId : in Integer) do

delay Duration(Random(RandNum) \* 5.0);

put("Shuttle #"); put(ShuttleId, 2); put(" is granted permission to land."); new\_line;

end PermissionToLand;

accept CallTheBall (ShuttleId : in Integer) do

delay Duration(Random(RandNum) \* 5.0);

put("Shuttle #"); put(ShuttleId, 2); put(" call the ball!"); new\_line;

end CallTheBall;

accept TouchDown (ShuttleId : in Integer) do

put("Shuttle #"); put(ShuttleId, 2); Put(", permission granted for final approach."); New\_Line;

delay Duration(Random(RandNum) \* 10.0);

end Touchdown;

end loop;

end LandingOfficer;

begin

for I in SpaceshipArray'Range loop

SpaceshipArray(I).Assign(I);

end loop;

Put("Shuttle operations are authorized."); New\_Line;

end;

end Boption;

**B Option Output**

Enter # of Ships: 10  
Enter # of Officers: 3  
Creating 10 ships and 3 officers...

Shuttle operations are authorized.

Shuttle # 3 reserved Landing Officer #1.

Shuttle # 3 entering its critical section.

Shuttle #10 reserved Landing Officer #2.

Shuttle #10 entering its critical section.

Shuttle # 8 reserved Landing Officer #3.

Shuttle # 8 entering its critical section.

Shuttle # 3 is granted permission to land.

Shuttle #10 is granted permission to land.

Shuttle # 8 is granted permission to land.

Shuttle # 8 call the ball!

Shuttle # 3 call the ball!

Shuttle # 8, permission granted for final approach.

Shuttle #10 call the ball!

Shuttle # 3, permission granted for final approach.

Shuttle #10, permission granted for final approach.

Shuttle #10 docked in 11.883808696 seconds.

Shuttle #10 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle #10 has taken off!

Shuttle # 2 reserved Landing Officer #2.

Shuttle # 2 entering its critical section.

Shuttle # 3 docked in 13.073514736 seconds.

Shuttle # 3 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 3 has taken off!

Shuttle # 7 reserved Landing Officer #1.

Shuttle # 7 entering its critical section.

Shuttle # 8 docked in 13.053644755 seconds.

Shuttle # 8 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 8 has taken off!

Shuttle # 6 reserved Landing Officer #3.

Shuttle # 6 entering its critical section.

Shuttle # 2 is granted permission to land.

Shuttle # 7 is granted permission to land.

Shuttle # 6 is granted permission to land.

Shuttle # 6 call the ball!

Shuttle # 2 call the ball!

Shuttle # 6, permission granted for final approach.

Shuttle # 7 call the ball!

Shuttle # 2, permission granted for final approach.

Shuttle # 7, permission granted for final approach.

Shuttle # 6 docked in 11.647101213 seconds.

Shuttle # 6 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 6 has taken off!

Shuttle # 5 reserved Landing Officer #3.

Shuttle # 5 entering its critical section.

Shuttle # 7 docked in 13.299160317 seconds.

Shuttle # 7 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 7 has taken off!

Shuttle # 1 reserved Landing Officer #1.

Shuttle # 1 entering its critical section.

Shuttle # 5 is granted permission to land.

Shuttle # 1 is granted permission to land.

Shuttle # 1 call the ball!

Shuttle # 5 call the ball!

Shuttle # 2 docked in 19.800235860 seconds.

Shuttle # 2 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 2 has taken off!

Shuttle # 4 reserved Landing Officer #2.

Shuttle # 4 entering its critical section.

Shuttle # 5, permission granted for final approach.

Shuttle # 1, permission granted for final approach.

Shuttle # 5 docked in 9.315311078 seconds.

Shuttle # 5 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 5 has taken off!

Shuttle # 9 reserved Landing Officer #3.

Shuttle # 9 entering its critical section.

Shuttle # 9 is granted permission to land.

Shuttle # 4 is granted permission to land.

Shuttle # 9 call the ball!

Shuttle # 9, permission granted for final approach.

Shuttle # 4 call the ball!

Shuttle # 1 docked in 10.802117443 seconds.

Shuttle # 1 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 1 has taken off!

Shuttle # 8 reserved Landing Officer #1.

Shuttle # 8 entering its critical section.

Shuttle # 4, permission granted for final approach.

Shuttle # 8 is granted permission to land.

Shuttle # 4 docked in 9.140130916 seconds.

Shuttle # 4 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 4 has taken off!

Shuttle #10 reserved Landing Officer #2.

Shuttle #10 entering its critical section.

Shuttle #10 is granted permission to land.

Shuttle # 8 call the ball!

Shuttle #10 call the ball!

Shuttle # 9 docked in 10.246843583 seconds.

Shuttle # 9 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 9 has taken off!

Shuttle # 3 reserved Landing Officer #3.

Shuttle # 3 entering its critical section.

Shuttle # 8, permission granted for final approach.

Shuttle # 3 is granted permission to land.

Shuttle # 3 call the ball!

Shuttle #10, permission granted for final approach.

Shuttle # 3, permission granted for final approach.

Shuttle # 8 docked in 11.556207230 seconds.

Shuttle # 8 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 8 has taken off!

Shuttle # 7 reserved Landing Officer #1.

Shuttle # 7 entering its critical section.

Shuttle # 3 docked in 6.358917815 seconds.

Shuttle # 3 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 3 has taken off!

Shuttle # 6 reserved Landing Officer #3.

Shuttle # 6 entering its critical section.

Shuttle # 7 is granted permission to land.

Shuttle #10 docked in 11.573092580 seconds.

Shuttle #10 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle #10 has taken off!

Shuttle # 1 reserved Landing Officer #2.

Shuttle # 1 entering its critical section.

Shuttle # 1 is granted permission to land.

Shuttle # 1 call the ball!

Shuttle # 6 is granted permission to land.

Shuttle # 1, permission granted for final approach.

Shuttle # 7 call the ball!

Shuttle # 7, permission granted for final approach.

Shuttle # 6 call the ball!

Shuttle # 6, permission granted for final approach.

Shuttle # 1 docked in 10.827245960 seconds.

Shuttle # 1 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 1 has taken off!

Shuttle # 2 reserved Landing Officer #2.

Shuttle # 2 entering its critical section.

Shuttle # 7 docked in 16.201474591 seconds.

Shuttle # 7 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 7 has taken off!

Shuttle # 5 reserved Landing Officer #1.

Shuttle # 5 entering its critical section.

Shuttle # 2 is granted permission to land.

Shuttle # 6 docked in 14.477655731 seconds.

Shuttle # 6 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 6 has taken off!

Shuttle # 4 reserved Landing Officer #3.

Shuttle # 4 entering its critical section.

Shuttle # 5 is granted permission to land.

Shuttle # 2 call the ball!

Shuttle # 4 is granted permission to land.

Shuttle # 4 call the ball!

Shuttle # 2, permission granted for final approach.

Shuttle # 4, permission granted for final approach.

Shuttle # 2 docked in 6.562331324 seconds.

Shuttle # 2 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 2 has taken off!

Shuttle # 8 reserved Landing Officer #2.

Shuttle # 8 entering its critical section.

Shuttle # 4 docked in 5.170598587 seconds.

Shuttle # 4 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 4 has taken off!

Shuttle # 9 reserved Landing Officer #3.

Shuttle # 9 entering its critical section.

Shuttle # 5 call the ball!

Shuttle # 8 is granted permission to land.

Shuttle # 8 call the ball!

Shuttle # 9 is granted permission to land.

Shuttle # 8, permission granted for final approach.

Shuttle # 5, permission granted for final approach.

Shuttle # 9 call the ball!

Shuttle # 9, permission granted for final approach.

Shuttle # 5 docked in 14.401637748 seconds.

Shuttle # 5 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 5 has taken off!

Shuttle # 3 reserved Landing Officer #1.

Shuttle # 3 entering its critical section.

Shuttle # 8 docked in 10.663721134 seconds.

Shuttle # 8 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 8 has taken off!

Shuttle #10 reserved Landing Officer #2.

Shuttle #10 entering its critical section.

Shuttle # 9 docked in 12.213285633 seconds.

Shuttle # 9 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 9 has taken off!

Shuttle # 7 reserved Landing Officer #3.

Shuttle # 7 entering its critical section.

Shuttle #10 is granted permission to land.

Shuttle # 3 is granted permission to land.

Shuttle # 7 is granted permission to land.

Shuttle # 7 call the ball!

Shuttle # 3 call the ball!

Shuttle #10 call the ball!

Shuttle # 3, permission granted for final approach.

Shuttle # 7, permission granted for final approach.

Shuttle #10, permission granted for final approach.

Shuttle #10 docked in 10.690581638 seconds.

Shuttle #10 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle #10 has taken off!

Shuttle # 6 reserved Landing Officer #2.

Shuttle # 6 entering its critical section.

Shuttle # 6 is granted permission to land.

Shuttle # 6 call the ball!

Shuttle # 7 docked in 12.161354530 seconds.

Shuttle # 7 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 7 has taken off!

Shuttle # 1 reserved Landing Officer #3.

Shuttle # 1 entering its critical section.

Shuttle # 1 is granted permission to land.

Shuttle # 6, permission granted for final approach.

Shuttle # 3 docked in 19.655224761 seconds.

Shuttle # 3 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 3 has taken off!

Shuttle # 4 reserved Landing Officer #1.

Shuttle # 4 entering its critical section.

Shuttle # 1 call the ball!

Shuttle # 4 is granted permission to land.

Shuttle # 4 call the ball!

Shuttle # 6 docked in 10.041904144 seconds.

Shuttle # 6 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 6 has taken off!

Shuttle # 2 reserved Landing Officer #2.

Shuttle # 2 entering its critical section.

Shuttle # 1, permission granted for final approach.

Shuttle # 4, permission granted for final approach.

Shuttle # 2 is granted permission to land.

Shuttle # 1 docked in 10.927491395 seconds.

Shuttle # 1 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 1 has taken off!

Shuttle # 9 reserved Landing Officer #3.

Shuttle # 9 entering its critical section.

Shuttle # 2 call the ball!

Shuttle # 2, permission granted for final approach.

Shuttle # 9 is granted permission to land.

Shuttle # 9 call the ball!

Shuttle # 4 docked in 13.170274950 seconds.

Shuttle # 4 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 4 has taken off!

Shuttle # 5 reserved Landing Officer #1.

Shuttle # 5 entering its critical section.

Shuttle # 9, permission granted for final approach.

Shuttle # 5 is granted permission to land.

Shuttle # 5 call the ball!

Shuttle # 2 docked in 17.420544672 seconds.

Shuttle # 2 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 2 has taken off!

Shuttle # 8 reserved Landing Officer #2.

Shuttle # 8 entering its critical section.

Shuttle # 5, permission granted for final approach.

Shuttle # 5 docked in 7.653048936 seconds.

Shuttle # 5 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 5 has taken off!

Shuttle #10 reserved Landing Officer #1.

Shuttle #10 entering its critical section.

Shuttle # 8 is granted permission to land.

Shuttle # 9 docked in 17.239049494 seconds.

Shuttle # 9 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 9 has taken off!

Shuttle # 3 reserved Landing Officer #3.

Shuttle # 3 entering its critical section.

Shuttle #10 is granted permission to land.

Shuttle # 8 call the ball!

Shuttle #10 call the ball!

Shuttle # 3 is granted permission to land.

Shuttle #10, permission granted for final approach.

Shuttle # 8, permission granted for final approach.

Shuttle # 3 call the ball!

Shuttle # 3, permission granted for final approach.

Shuttle #10 docked in 15.294379088 seconds.

Shuttle #10 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle #10 has taken off!

Shuttle # 7 reserved Landing Officer #1.

Shuttle # 7 entering its critical section.

Shuttle # 8 docked in 18.041427419 seconds.

Shuttle # 8 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 8 has taken off!

Shuttle # 1 reserved Landing Officer #2.

Shuttle # 1 entering its critical section.

Shuttle # 1 is granted permission to land.

Shuttle # 7 is granted permission to land.

Shuttle # 3 docked in 16.125591360 seconds.

Shuttle # 3 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 3 has taken off!

Shuttle # 6 reserved Landing Officer #3.

Shuttle # 6 entering its critical section.

Shuttle # 6 is granted permission to land.

Shuttle # 7 call the ball!

Shuttle # 1 call the ball!

Shuttle # 1, permission granted for final approach.

Shuttle # 1 docked in 7.101021061 seconds.

Shuttle # 1 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 1 has taken off!

Shuttle # 5 reserved Landing Officer #2.

Shuttle # 5 entering its critical section.

Shuttle # 5 is granted permission to land.

Shuttle # 7, permission granted for final approach.

Shuttle # 6 call the ball!

Shuttle # 5 call the ball!

Shuttle # 6, permission granted for final approach.

Shuttle # 5, permission granted for final approach.

Shuttle # 7 docked in 15.406374739 seconds.

Shuttle # 7 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 7 has taken off!

Shuttle # 4 reserved Landing Officer #1.

Shuttle # 4 entering its critical section.

Shuttle # 5 docked in 7.122384956 seconds.

Shuttle # 5 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 5 has taken off!

Shuttle # 9 reserved Landing Officer #2.

Shuttle # 9 entering its critical section.

Shuttle # 4 is granted permission to land.

Shuttle # 4 call the ball!

Shuttle # 4, permission granted for final approach.

Shuttle # 9 is granted permission to land.

Shuttle # 6 docked in 15.228232066 seconds.

Shuttle # 6 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 6 has taken off!

Shuttle # 2 reserved Landing Officer #3.

Shuttle # 2 entering its critical section.

Shuttle # 2 is granted permission to land.

Shuttle # 9 call the ball!

Shuttle # 9, permission granted for final approach.

Shuttle # 2 call the ball!

Shuttle # 4 docked in 7.921982271 seconds.

Shuttle # 4 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 4 has taken off!

Shuttle #10 reserved Landing Officer #1.

Shuttle #10 entering its critical section.

Shuttle #10 is granted permission to land.

Shuttle # 2, permission granted for final approach.

Shuttle #10 call the ball!

Shuttle #10, permission granted for final approach.

Shuttle # 2 docked in 6.953183076 seconds.

Shuttle # 2 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 2 has taken off!

Shuttle # 8 reserved Landing Officer #3.

Shuttle # 8 entering its critical section.

Shuttle #10 docked in 6.565105821 seconds.

Shuttle #10 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle #10 has taken off!

Shuttle # 3 reserved Landing Officer #1.

Shuttle # 3 entering its critical section.

Shuttle # 8 is granted permission to land.

Shuttle # 9 docked in 15.069897964 seconds.

Shuttle # 9 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 9 has taken off!

Shuttle # 7 reserved Landing Officer #2.

Shuttle # 7 entering its critical section.

Shuttle # 3 is granted permission to land.

Shuttle # 3 call the ball!

Shuttle # 7 is granted permission to land.

Shuttle # 8 call the ball!

Shuttle # 3, permission granted for final approach.

Shuttle # 8, permission granted for final approach.

Shuttle # 7 call the ball!

Shuttle # 7, permission granted for final approach.

Shuttle # 3 docked in 10.492113796 seconds.

Shuttle # 3 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 3 has taken off!

Shuttle # 1 reserved Landing Officer #1.

Shuttle # 1 entering its critical section.

Shuttle # 1 is granted permission to land.

Shuttle # 8 docked in 17.421226292 seconds.

Shuttle # 8 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 8 has taken off!

Shuttle # 6 reserved Landing Officer #3.

Shuttle # 6 entering its critical section.

Shuttle # 1 call the ball!

Shuttle # 7 docked in 14.730334404 seconds.

Shuttle # 7 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 7 has taken off!

Shuttle # 5 reserved Landing Officer #2.

Shuttle # 5 entering its critical section.

Shuttle # 5 is granted permission to land.

Shuttle # 1, permission granted for final approach.

Shuttle # 6 is granted permission to land.

Shuttle # 5 call the ball!

Shuttle # 5, permission granted for final approach.

Shuttle # 1 docked in 8.978116013 seconds.

Shuttle # 1 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 1 has taken off!

Shuttle # 9 reserved Landing Officer #1.

Shuttle # 9 entering its critical section.

Shuttle # 5 docked in 4.927863346 seconds.

Shuttle # 5 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 5 has taken off!

Shuttle # 4 reserved Landing Officer #2.

Shuttle # 4 entering its critical section.

Shuttle # 6 call the ball!

Shuttle # 9 is granted permission to land.

Shuttle # 9 call the ball!

Shuttle # 6, permission granted for final approach.

Shuttle # 4 is granted permission to land.

Shuttle # 9, permission granted for final approach.

Shuttle # 4 call the ball!

Shuttle # 6 docked in 14.407659395 seconds.

Shuttle # 6 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 6 has taken off!

Shuttle # 2 reserved Landing Officer #3.

Shuttle # 2 entering its critical section.

Shuttle # 2 is granted permission to land.

Shuttle # 4, permission granted for final approach.

Shuttle # 2 call the ball!

Shuttle # 4 docked in 11.065195899 seconds.

Shuttle # 4 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #2 is now free for use.

Shuttle # 4 has taken off!

Shuttle # 9 docked in 12.982490657 seconds.

Shuttle # 9 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #1 is now free for use.

Shuttle # 9 has taken off!

Shuttle # 2, permission granted for final approach.

Shuttle # 2 docked in 12.983067501 seconds.

Shuttle # 2 is leaving its critical section. Obtain new crew and start next mission.

Landing Officer #3 is now free for use.

Shuttle # 2 has taken off!

**A Option Code**

**Monitor2.abs**

generic

type Item is limited private;

Max\_Resource : in Positive;

package Monitor2 is

subtype Item\_Range is Positive range 1..Max\_Resource;

type Reservable\_Item is

record

Reserved : Boolean := False;

Resource : aliased Item;

end record;

type Reservable\_Item\_Array is array (Item\_Range) of Reservable\_Item;

type Item\_Ptr is access all Item;

type Reservable\_Item\_Array\_Ptr is access all Reservable\_Item\_Array;

protected type Resource\_Monitor is

procedure Initialize(Input\_Array : in Reservable\_Item\_Array\_Ptr);

entry Reserve (Id : out Integer; Resource\_Ptr : out Item\_Ptr);

procedure Release (Id : in Integer);

function Available return Boolean;

private

Resource\_List : Reservable\_Item\_Array\_Ptr;

Initialized : Boolean := False;

end Resource\_Monitor;

end Monitor2;

**Monitor2.adb**

package body Monitor2 is

protected body Resource\_Monitor is

procedure Initialize (Input\_Array : in Reservable\_Item\_Array\_Ptr) is

begin

Resource\_List := Input\_Array;

Initialized := True;

end Initialize;

entry Reserve (Id : out Integer; Resource\_Ptr : out Item\_Ptr) when Initialized and then Available is

begin

ReserveLoop:

for I in Resource\_List'range loop

if Resource\_List(I).Reserved = False then

Id := I;

Resource\_Ptr := Resource\_List(I).Resource'Unchecked\_Access;

Resource\_List(I).Reserved := True;

exit ReserveLoop;

end if;

end loop ReserveLoop;

end Reserve;

procedure Release (Id : in Integer) is

begin

Resource\_List(Id).Reserved := False;

end Release;

function Available return Boolean is

begin

for I in Resource\_List'range loop

if Resource\_List(I).Reserved = False then

return True;

end if;

end loop;

return false;

end Available;

end Resource\_Monitor;

end Monitor2;

**Aoption2.adb**

with Ada.Text\_IO, Ada.Calendar, Ada.Numerics.Float\_Random, Monitor2;

use Ada.Text\_IO, Ada.Calendar, Ada.Numerics.Float\_Random;

procedure Aoption2 is

package Duration\_IO is new Ada.Text\_IO.Fixed\_IO(duration); use Duration\_IO;

package integerIO is new Ada.Text\_IO.Integer\_IO(integer); use integerIO;

RandNum: Generator;

task type LandingOfficer is

entry PermissionToLand (ShuttleId : in Integer);

entry CallTheBall (ShuttleId : in Integer);

entry TouchDown (ShuttleId: in Integer);

end LandingOfficer;

task body LandingOfficer is

begin

loop

accept PermissionToLand (ShuttleId : in Integer) do

delay Duration(Random(RandNum) \* 5.0);

put("Shuttle #"); put(ShuttleId, 2); put(" is granted permission to land."); new\_line;

end PermissionToLand;

accept CallTheBall (ShuttleId : in Integer) do

delay Duration(Random(RandNum) \* 5.0);

put("Shuttle #"); put(ShuttleId, 2); put(" call the ball!"); new\_line;

end CallTheBall;

accept TouchDown (ShuttleId : in Integer) do

put("Shuttle #"); put(ShuttleId, 2); Put(", permission granted for final approach."); New\_Line;

delay Duration(Random(RandNum) \* 10.0);

end Touchdown;

end loop;

end LandingOfficer;

ShipCount : Integer;

OfficerCount : Integer;

begin

Put("Enter # of Ships: "); Get(ShipCount);

Put("Enter # of Officers: "); Get(OfficerCount);

Put("Creating "); Put(ShipCount, 2); Put(" ships and "); Put(OfficerCount, 2); Put(" officers..."); New\_Line;

declare

package OfficerMonitorPackage is new Monitor2(LandingOfficer, OfficerCount); use OfficerMonitorPackage;

task type Spaceship is

entry Assign(ShuttleId : in Integer);

end Spaceship;

SpaceshipArray : array (1..ShipCount) of Spaceship;

OfficerArray : aliased Reservable\_Item\_Array;

OfficerMonitor : Resource\_Monitor;

task body Spaceship is

initiateLandingSequence: Duration;

LandingComplete: Duration;

OfficerId : Integer;

ID : Integer;

OfficerPtr : Item\_Ptr;

begin

accept Assign (ShuttleId : in Integer) do

ID := ShuttleId;

end Assign;

for I in 1..5 loop

delay Duration(Random(RandNum) \* 15.0); --Crew performing mission.

OfficerMonitor.Reserve(OfficerId, OfficerPtr);

Put("Shuttle #"); Put(ID, 2); Put(" reserved Landing Officer #"); Put(OfficerId, 1); Put(".");

New\_line;

Put("Shuttle #"); Put(ID, 2); Put(" entering its critical section.");

New\_line(2);

initiateLandingSequence:= seconds(clock);

OfficerPtr.PermissionToLand(ID);

OfficerPtr.CallTheBall(ID);

delay Duration(Random(randNum) \* 3.0); -- line up shuttle with mother ship

OfficerPtr.TouchDown(ID);

landingComplete := seconds(clock);

put("Shuttle #"); put(ID, 2); put(" docked in "); put( landingComplete - initiateLandingSequence, 2 );

Put(" seconds." );

New\_line;

put("Shuttle #"); put(ID, 2); put(" is leaving its critical section. Obtain new crew and start next mission.");

New\_Line(2);

Put("Shuttle #"); Put(ID, 2); Put(" has taken off!");

New\_Line;

OfficerMonitor.Release(OfficerId);

end loop;

end Spaceship;

begin

OfficerMonitor.Initialize(OfficerArray'Unchecked\_Access);

for I in SpaceshipArray'Range loop

SpaceshipArray(I).Assign(I);

end loop;

Put("Shuttle operations are authorized."); New\_Line;

end;

end Aoption2;

**A Option Output**

Output for Version:

Enter # of Ships: 10

Enter # of Officers: 3

Creating 10 ships and 3 officers...

Shuttle operations are authorized.

Shuttle # 3 reserved Landing Officer #1.

Shuttle # 3 entering its critical section.

Shuttle #10 reserved Landing Officer #2.

Shuttle #10 entering its critical section.

Shuttle # 8 reserved Landing Officer #3.

Shuttle # 8 entering its critical section.

Shuttle # 3 is granted permission to land.

Shuttle #10 is granted permission to land.

Shuttle # 8 is granted permission to land.

Shuttle # 8 call the ball!

Shuttle # 3 call the ball!

Shuttle # 8, permission granted for final approach.

Shuttle #10 call the ball!

Shuttle # 3, permission granted for final approach.

Shuttle #10, permission granted for final approach.

Shuttle #10 docked in 11.884153289 seconds.

Shuttle #10 is leaving its critical section. Obtain new crew and start next mission.

Shuttle #10 has taken off!

Shuttle # 2 reserved Landing Officer #2.

Shuttle # 2 entering its critical section.

Shuttle # 3 docked in 13.072927705 seconds.

Shuttle # 3 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 3 has taken off!

Shuttle # 7 reserved Landing Officer #1.

Shuttle # 7 entering its critical section.

Shuttle # 8 docked in 13.053451504 seconds.

Shuttle # 8 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 8 has taken off!

Shuttle # 6 reserved Landing Officer #3.

Shuttle # 6 entering its critical section.

Shuttle # 2 is granted permission to land.

Shuttle # 7 is granted permission to land.

Shuttle # 6 is granted permission to land.

Shuttle # 6 call the ball!

Shuttle # 2 call the ball!

Shuttle # 6, permission granted for final approach.

Shuttle # 7 call the ball!

Shuttle # 2, permission granted for final approach.

Shuttle # 7, permission granted for final approach.

Shuttle # 6 docked in 11.647322696 seconds.

Shuttle # 6 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 6 has taken off!

Shuttle # 5 reserved Landing Officer #3.

Shuttle # 5 entering its critical section.

Shuttle # 7 docked in 13.299440298 seconds.

Shuttle # 7 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 7 has taken off!

Shuttle # 1 reserved Landing Officer #1.

Shuttle # 1 entering its critical section.

Shuttle # 5 is granted permission to land.

Shuttle # 1 is granted permission to land.

Shuttle # 1 call the ball!

Shuttle # 5 call the ball!

Shuttle # 2 docked in 19.800390112 seconds.

Shuttle # 2 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 2 has taken off!

Shuttle # 4 reserved Landing Officer #2.

Shuttle # 4 entering its critical section.

Shuttle # 5, permission granted for final approach.

Shuttle # 1, permission granted for final approach.

Shuttle # 5 docked in 9.315166721 seconds.

Shuttle # 5 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 5 has taken off!

Shuttle # 9 reserved Landing Officer #3.

Shuttle # 9 entering its critical section.

Shuttle # 9 is granted permission to land.

Shuttle # 4 is granted permission to land.

Shuttle # 9 call the ball!

Shuttle # 9, permission granted for final approach.

Shuttle # 4 call the ball!

Shuttle # 1 docked in 10.802099981 seconds.

Shuttle # 1 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 1 has taken off!

Shuttle # 8 reserved Landing Officer #1.

Shuttle # 8 entering its critical section.

Shuttle # 4, permission granted for final approach.

Shuttle # 8 is granted permission to land.

Shuttle # 4 docked in 9.140220848 seconds.

Shuttle # 4 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 4 has taken off!

Shuttle #10 reserved Landing Officer #2.

Shuttle #10 entering its critical section.

Shuttle #10 is granted permission to land.

Shuttle # 8 call the ball!

Shuttle #10 call the ball!

Shuttle # 9 docked in 10.247221937 seconds.

Shuttle # 9 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 9 has taken off!

Shuttle # 3 reserved Landing Officer #3.

Shuttle # 3 entering its critical section.

Shuttle # 8, permission granted for final approach.

Shuttle # 3 is granted permission to land.

Shuttle # 3 call the ball!

Shuttle #10, permission granted for final approach.

Shuttle # 3, permission granted for final approach.

Shuttle # 8 docked in 11.555429858 seconds.

Shuttle # 8 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 8 has taken off!

Shuttle # 7 reserved Landing Officer #1.

Shuttle # 7 entering its critical section.

Shuttle # 3 docked in 6.358946337 seconds.

Shuttle # 3 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 3 has taken off!

Shuttle # 6 reserved Landing Officer #3.

Shuttle # 6 entering its critical section.

Shuttle # 7 is granted permission to land.

Shuttle #10 docked in 11.573173490 seconds.

Shuttle #10 is leaving its critical section. Obtain new crew and start next mission.

Shuttle #10 has taken off!

Shuttle # 1 reserved Landing Officer #2.

Shuttle # 1 entering its critical section.

Shuttle # 1 is granted permission to land.

Shuttle # 1 call the ball!

Shuttle # 6 is granted permission to land.

Shuttle # 1, permission granted for final approach.

Shuttle # 7 call the ball!

Shuttle # 7, permission granted for final approach.

Shuttle # 6 call the ball!

Shuttle # 6, permission granted for final approach.

Shuttle # 1 docked in 10.827351899 seconds.

Shuttle # 1 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 1 has taken off!

Shuttle # 2 reserved Landing Officer #2.

Shuttle # 2 entering its critical section.

Shuttle # 7 docked in 16.201286868 seconds.

Shuttle # 7 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 7 has taken off!

Shuttle # 5 reserved Landing Officer #1.

Shuttle # 5 entering its critical section.

Shuttle # 2 is granted permission to land.

Shuttle # 6 docked in 14.477701424 seconds.

Shuttle # 6 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 6 has taken off!

Shuttle # 4 reserved Landing Officer #3.

Shuttle # 4 entering its critical section.

Shuttle # 5 is granted permission to land.

Shuttle # 2 call the ball!

Shuttle # 4 is granted permission to land.

Shuttle # 4 call the ball!

Shuttle # 2, permission granted for final approach.

Shuttle # 4, permission granted for final approach.

Shuttle # 2 docked in 6.561890395 seconds.

Shuttle # 2 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 2 has taken off!

Shuttle # 8 reserved Landing Officer #2.

Shuttle # 8 entering its critical section.

Shuttle # 4 docked in 5.170560752 seconds.

Shuttle # 4 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 4 has taken off!

Shuttle # 9 reserved Landing Officer #3.

Shuttle # 9 entering its critical section.

Shuttle # 5 call the ball!

Shuttle # 8 is granted permission to land.

Shuttle # 8 call the ball!

Shuttle # 9 is granted permission to land.

Shuttle # 8, permission granted for final approach.

Shuttle # 5, permission granted for final approach.

Shuttle # 9 call the ball!

Shuttle # 9, permission granted for final approach.

Shuttle # 5 docked in 14.401690717 seconds.

Shuttle # 5 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 5 has taken off!

Shuttle # 3 reserved Landing Officer #1.

Shuttle # 3 entering its critical section.

Shuttle # 8 docked in 10.663261288 seconds.

Shuttle # 8 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 8 has taken off!

Shuttle #10 reserved Landing Officer #2.

Shuttle #10 entering its critical section.

Shuttle # 9 docked in 12.213456766 seconds.

Shuttle # 9 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 9 has taken off!

Shuttle # 7 reserved Landing Officer #3.

Shuttle # 7 entering its critical section.

Shuttle #10 is granted permission to land.

Shuttle # 3 is granted permission to land.

Shuttle # 7 is granted permission to land.

Shuttle # 7 call the ball!

Shuttle # 3 call the ball!

Shuttle #10 call the ball!

Shuttle # 3, permission granted for final approach.

Shuttle # 7, permission granted for final approach.

Shuttle #10, permission granted for final approach.

Shuttle #10 docked in 10.690478318 seconds.

Shuttle #10 is leaving its critical section. Obtain new crew and start next mission.

Shuttle #10 has taken off!

Shuttle # 6 reserved Landing Officer #2.

Shuttle # 6 entering its critical section.

Shuttle # 6 is granted permission to land.

Shuttle # 6 call the ball!

Shuttle # 7 docked in 12.161213957 seconds.

Shuttle # 7 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 7 has taken off!

Shuttle # 1 reserved Landing Officer #3.

Shuttle # 1 entering its critical section.

Shuttle # 1 is granted permission to land.

Shuttle # 6, permission granted for final approach.

Shuttle # 3 docked in 19.655302178 seconds.

Shuttle # 3 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 3 has taken off!

Shuttle # 4 reserved Landing Officer #1.

Shuttle # 4 entering its critical section.

Shuttle # 1 call the ball!

Shuttle # 4 is granted permission to land.

Shuttle # 4 call the ball!

Shuttle # 6 docked in 10.042056068 seconds.

Shuttle # 6 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 6 has taken off!

Shuttle # 2 reserved Landing Officer #2.

Shuttle # 2 entering its critical section.

Shuttle # 1, permission granted for final approach.

Shuttle # 4, permission granted for final approach.

Shuttle # 2 is granted permission to land.

Shuttle # 1 docked in 10.927478298 seconds.

Shuttle # 1 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 1 has taken off!

Shuttle # 9 reserved Landing Officer #3.

Shuttle # 9 entering its critical section.

Shuttle # 2 call the ball!

Shuttle # 2, permission granted for final approach.

Shuttle # 9 is granted permission to land.

Shuttle # 9 call the ball!

Shuttle # 4 docked in 13.170285137 seconds.

Shuttle # 4 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 4 has taken off!

Shuttle # 5 reserved Landing Officer #1.

Shuttle # 5 entering its critical section.

Shuttle # 9, permission granted for final approach.

Shuttle # 5 is granted permission to land.

Shuttle # 5 call the ball!

Shuttle # 2 docked in 17.421359006 seconds.

Shuttle # 2 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 2 has taken off!

Shuttle # 8 reserved Landing Officer #2.

Shuttle # 8 entering its critical section.

Shuttle # 5, permission granted for final approach.

Shuttle # 5 docked in 7.652995675 seconds.

Shuttle # 5 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 5 has taken off!

Shuttle #10 reserved Landing Officer #1.

Shuttle #10 entering its critical section.

Shuttle # 8 is granted permission to land.

Shuttle # 9 docked in 17.238343427 seconds.

Shuttle # 9 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 9 has taken off!

Shuttle # 3 reserved Landing Officer #3.

Shuttle # 3 entering its critical section.

Shuttle #10 is granted permission to land.

Shuttle # 8 call the ball!

Shuttle #10 call the ball!

Shuttle # 3 is granted permission to land.

Shuttle #10, permission granted for final approach.

Shuttle # 8, permission granted for final approach.

Shuttle # 3 call the ball!

Shuttle # 3, permission granted for final approach.

Shuttle #10 docked in 15.295488247 seconds.

Shuttle #10 is leaving its critical section. Obtain new crew and start next mission.

Shuttle #10 has taken off!

Shuttle # 7 reserved Landing Officer #1.

Shuttle # 7 entering its critical section.

Shuttle # 8 docked in 18.041546745 seconds.

Shuttle # 8 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 8 has taken off!

Shuttle # 1 reserved Landing Officer #2.

Shuttle # 1 entering its critical section.

Shuttle # 1 is granted permission to land.

Shuttle # 7 is granted permission to land.

Shuttle # 3 docked in 16.126179263 seconds.

Shuttle # 3 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 3 has taken off!

Shuttle # 6 reserved Landing Officer #3.

Shuttle # 6 entering its critical section.

Shuttle # 6 is granted permission to land.

Shuttle # 7 call the ball!

Shuttle # 1 call the ball!

Shuttle # 1, permission granted for final approach.

Shuttle # 1 docked in 7.101037068 seconds.

Shuttle # 1 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 1 has taken off!

Shuttle # 5 reserved Landing Officer #2.

Shuttle # 5 entering its critical section.

Shuttle # 5 is granted permission to land.

Shuttle # 7, permission granted for final approach.

Shuttle # 6 call the ball!

Shuttle # 5 call the ball!

Shuttle # 6, permission granted for final approach.

Shuttle # 5, permission granted for final approach.

Shuttle # 7 docked in 15.406382015 seconds.

Shuttle # 7 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 7 has taken off!

Shuttle # 4 reserved Landing Officer #1.

Shuttle # 4 entering its critical section.

Shuttle # 5 docked in 7.120969622 seconds.

Shuttle # 5 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 5 has taken off!

Shuttle # 9 reserved Landing Officer #2.

Shuttle # 9 entering its critical section.

Shuttle # 4 is granted permission to land.

Shuttle # 4 call the ball!

Shuttle # 4, permission granted for final approach.

Shuttle # 9 is granted permission to land.

Shuttle # 6 docked in 15.227608073 seconds.

Shuttle # 6 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 6 has taken off!

Shuttle # 2 reserved Landing Officer #3.

Shuttle # 2 entering its critical section.

Shuttle # 2 is granted permission to land.

Shuttle # 9 call the ball!

Shuttle # 9, permission granted for final approach.

Shuttle # 2 call the ball!

Shuttle # 4 docked in 7.921070439 seconds.

Shuttle # 4 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 4 has taken off!

Shuttle #10 reserved Landing Officer #1.

Shuttle #10 entering its critical section.

Shuttle #10 is granted permission to land.

Shuttle # 2, permission granted for final approach.

Shuttle #10 call the ball!

Shuttle #10, permission granted for final approach.

Shuttle # 2 docked in 6.953044249 seconds.

Shuttle # 2 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 2 has taken off!

Shuttle # 8 reserved Landing Officer #3.

Shuttle # 8 entering its critical section.

Shuttle #10 docked in 6.565072643 seconds.

Shuttle #10 is leaving its critical section. Obtain new crew and start next mission.

Shuttle #10 has taken off!

Shuttle # 3 reserved Landing Officer #1.

Shuttle # 3 entering its critical section.

Shuttle # 8 is granted permission to land.

Shuttle # 9 docked in 15.069388350 seconds.

Shuttle # 9 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 9 has taken off!

Shuttle # 7 reserved Landing Officer #2.

Shuttle # 7 entering its critical section.

Shuttle # 3 is granted permission to land.

Shuttle # 3 call the ball!

Shuttle # 7 is granted permission to land.

Shuttle # 8 call the ball!

Shuttle # 3, permission granted for final approach.

Shuttle # 8, permission granted for final approach.

Shuttle # 7 call the ball!

Shuttle # 7, permission granted for final approach.

Shuttle # 3 docked in 10.492204310 seconds.

Shuttle # 3 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 3 has taken off!

Shuttle # 1 reserved Landing Officer #1.

Shuttle # 1 entering its critical section.

Shuttle # 1 is granted permission to land.

Shuttle # 8 docked in 17.421461453 seconds.

Shuttle # 8 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 8 has taken off!

Shuttle # 6 reserved Landing Officer #3.

Shuttle # 6 entering its critical section.

Shuttle # 1 call the ball!

Shuttle # 7 docked in 14.729595449 seconds.

Shuttle # 7 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 7 has taken off!

Shuttle # 5 reserved Landing Officer #2.

Shuttle # 5 entering its critical section.

Shuttle # 5 is granted permission to land.

Shuttle # 1, permission granted for final approach.

Shuttle # 6 is granted permission to land.

Shuttle # 5 call the ball!

Shuttle # 5, permission granted for final approach.

Shuttle # 1 docked in 8.979063062 seconds.

Shuttle # 1 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 1 has taken off!

Shuttle # 9 reserved Landing Officer #1.

Shuttle # 9 entering its critical section.

Shuttle # 5 docked in 4.928771104 seconds.

Shuttle # 5 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 5 has taken off!

Shuttle # 4 reserved Landing Officer #2.

Shuttle # 4 entering its critical section.

Shuttle # 6 call the ball!

Shuttle # 9 is granted permission to land.

Shuttle # 9 call the ball!

Shuttle # 6, permission granted for final approach.

Shuttle # 4 is granted permission to land.

Shuttle # 9, permission granted for final approach.

Shuttle # 4 call the ball!

Shuttle # 6 docked in 14.407490010 seconds.

Shuttle # 6 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 6 has taken off!

Shuttle # 2 reserved Landing Officer #3.

Shuttle # 2 entering its critical section.

Shuttle # 2 is granted permission to land.

Shuttle # 4, permission granted for final approach.

Shuttle # 2 call the ball!

Shuttle # 4 docked in 11.065185130 seconds.

Shuttle # 4 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 4 has taken off!

Shuttle # 9 docked in 12.982606782 seconds.

Shuttle # 9 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 9 has taken off!

Shuttle # 2, permission granted for final approach.

Shuttle # 2 docked in 12.982969420 seconds.

Shuttle # 2 is leaving its critical section. Obtain new crew and start next mission.

Shuttle # 2 has taken off!