

Exercise Sheet 1

Due: October 04, 2023

(Communication by exchanging messages)

- This is a set of exercises to support the communication section.
- All programs must be tested on more than one machine and communicates through a network.
- Solutions are graded A–C to indicate the effort expected (An A would be worth a few marks, a C worth much more).

Exercise 01:

Consider the architecture of a distributed system (S) composed of four processes (P1, P2, P3, P4). These processes are distributed respectively over four sites (M1, M2, M3 and M4) and connected by the physical topology indicated in the figure .1. The communication mode used in this system is shown in Figure 1.

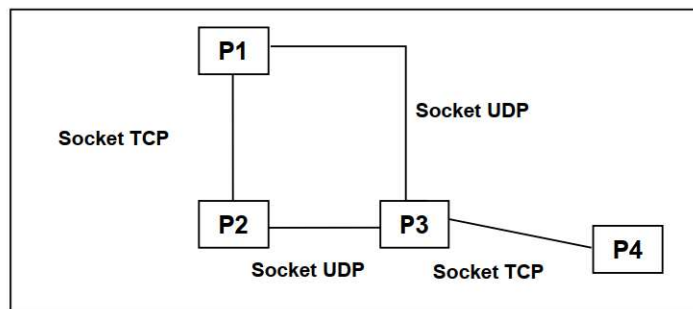


Figure 1. System architecture.

The operation of the system (S) is described in the following table.

Program	Role
P1	<ul style="list-style-type: none">– Reads N (N is an integer).– Sends N to P2.– Displays the message received (Ack) from P3.
P2	<ul style="list-style-type: none">– Reads M (M is an integer).– Sends N and M to P3.
P3	<ul style="list-style-type: none">– Calculates S ($S=N+M$).– Calculates the product (P) of all prime numbers less than or equal to S. (Example $S=13$, product $P = 2 \times 3 \times 5 \times 7 \times 11 \times 13$).– Sends a notification (message = Ack) to P1.– Sends P and S to P4.
P4	<ul style="list-style-type: none">– Displays the multiplication table of P (Example: $P = 20$, the multiplication table is: $20 \times 1 = 20, 20 \times 2 = 40, \dots, 20 \times 9 = 180, 20 \times 10 = 200$).– Displays divisors of P.

	– Calculates: fact (S).
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At the end of processing, the results fact (S) and P must be displayed by the process P1.

- Write the Java codes of P1, P2, P3 and P4 program.

Exercise 02:

Consider the architecture of a distributed system (S) composed of four processes (P1, P2, P3, P4). These processes are distributed respectively over four sites (M1, M2, M3 and M4) and connected by the physical topology indicated in the figure .1. The communication mode used in this system is shown in Figure 1.

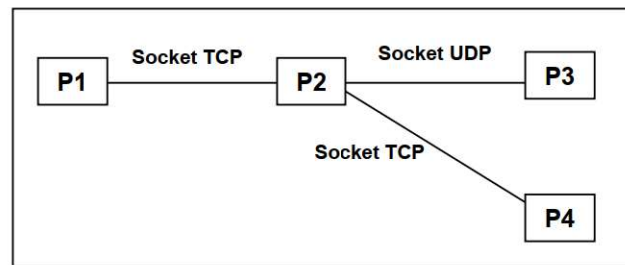


Figure 1. System architecture.

The operation of the system (S) is described in the following table.

Program	Role
P1	<ul style="list-style-type: none">– Reads N (N is an integer).– Sends N to P2.
P2	<ul style="list-style-type: none">– Calculates S1 ($S1=N*2$).– Sends S1 to P3.
P3	<ul style="list-style-type: none">– Calculates S2 ($S2=S1*3$).– Sends S2 to P4 (Via P2).
P4	<ul style="list-style-type: none">– Calculates S3 ($S3=S2*4$).– Sends S3 to P2.

At the end of processing, S3 must be displayed by the process P2.

- Write the Java codes of P1, P2, P3 and P4 program.

Exercise 03:

Consider the architecture of a distributed system (S) composed of four processes (P1, P2, P3, P4). These processes are distributed respectively over four sites (M1, M2, M3 and M4) and connected by

the physical topology indicated in the figure .1. The communication mode used in this system is shown in Figure 1.

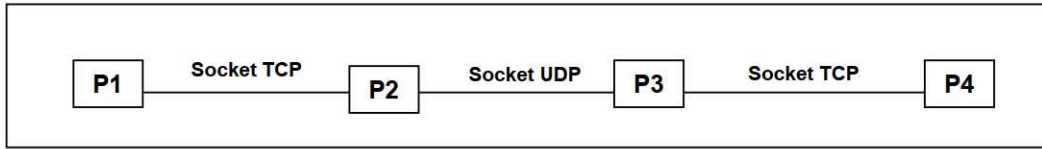


Figure 1. System architecture.

The operation of the system (S) is described in the following table.

Program	Role
P1	<ul style="list-style-type: none">– Reads N (N is an integer).– Sends N to P2.
P2	<ul style="list-style-type: none">– Calculates S1 ($S1=N*2$).– Sends S1 to P3.
P3	<ul style="list-style-type: none">– Calculates S2 ($S2=S1*3$).– Sends S2 to P4.
P4	<ul style="list-style-type: none">– Calculates S3 ($S3=S2*4$).– Sends S3 to P1.

At the end of processing, S3 must be displayed by the process P1.

- Write the Java codes of P1, P2, P3 and P4 program.