Seminar Report: Ordy

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1 Introduction

La tasca d'aquesta pràctica és implementar un servei de multicast que suporti diferents models d'ordenació de missatges. Tindrem un conjunt de "workers" que és comunicaran entre ells mitjançant un sistema de multicast. Els processos multicast estaran connectats entre ells i hauran de decidir en quin ordre entreguen els missatges als workers. Els processos multicast rebran els missatges sense un ordre específic, però hauran de ser precisos alhora de fer el "delivery" d'aquests. Tenim tres modes d'ordenació:

- **Bàsic:** En aquesta versió no disposem de cap mecanisme d'ordenació, simplement entreguem tots els missatges que rebem sense ordre específic.

- **Causal:** Els missatges relacionats són entregats de forma ordenada per tots els processos (també es respecte l'ordenació FIFO).

- **Total:** Tots els missatges són entregats en el mateix ordre per tots els processos.

2 Experiments

2.1 Basic

2.1.1 2000,0

En aquest cas ens trobem en un escenari on no tenim Jitter, per tant partim de la hipòtesis que tots els missatges haurien d'estar ordenats, ja que no tenim cap agent que faci que un missatge A enviat abans que un missatge B arribi als altres nodes abans.

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————————p1————————————
P1 RECV(    1) ; From: P2(    1) ; Subject: kaxibrmz
P1 SEND(    1) ; Subject: Re:kaxibrmz
P1 RECV(    2) ; From: P1(    1) ; Subject: Re:kaxibrmz
P1 RECV(    3) ; From: P3(    1) ; Subject: Re:Re:kaxibrmz
P1 SEND(    2) ; Subject: Re:Re:Re:kaxibrmz
P1 RECV(    4) ; From: P1(    2) ; Subject: Re:Re:Re:kaxibrmz
P1 RECV(    5) ; From: P4(    1) ; Subject: hikmylas
P1 RECV(    6) ; From: P2(    2) ; Subject: Re:hikmylas
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P1 SEND(     3)  ;  Subject:  chlpotiv
P1 RECV(     7)  ;  From:  P1(     3)  ;  Subject:  chlpotiv
P1 RECV(     8)  ;  From:  P3(     2)  ;  Subject:  Re:chlpotiv
P1 SEND(     4)  ;  Subject:  Re:Re:chlpotiv
P1 RECV(     9)  ;  From:  P1(     4)  ;  Subject:  Re:Re:chlpotiv
P1 RECV(    10)  ;  From:  P4(     2)  ;  Subject:  mqcgokrl
P1 RECV(    11)  ;  From:  P3(     3)  ;  Subject:  ehqrkvga

————————————————p2————————————————
P2 SEND(     1)  ;  Subject:  Re:kaxibrmz
P2 RECV(     2)  ;  From:  P1(     1)  ;  Subject:  Re:kaxibrmz
P2 RECV(     3)  ;  From:  P3(     1)  ;  Subject:  Re:Re:kaxibrmz
P2 SEND(     2)  ;  Subject:  Re:Re:Re:kaxibrmz
P2 RECV(     4)  ;  From:  P1(     2)  ;  Subject:  Re:Re:Re:kaxibrmz
P2 RECV(     5)  ;  From:  P4(     1)  ;  Subject:  hikmylas
P2 RECV(     6)  ;  From:  P2(     2)  ;  Subject:  Re:hikmylas
P2 SEND(     3)  ;  Subject:  chlpotiv
P2 RECV(     7)  ;  From:  P1(     3)  ;  Subject:  chlpotiv
P2 RECV(     8)  ;  From:  P3(     2)  ;  Subject:  Re:chlpotiv
P2 SEND(     4)  ;  Subject:  Re:Re:chlpotiv
P2 RECV(     9)  ;  From:  P1(     4)  ;  Subject:  Re:Re:chlpotiv
P2 RECV(    10)  ;  From:  P4(     2)  ;  Subject:  mqcgokrl
P2 RECV(    11)  ;  From:  P3(     3)  ;  Subject:  ehqrkvga

————————————————p3————————————————
P3 RECV(     1)  ;  From:  P2(     1)  ;  Subject:  kaxibrmz
P3 RECV(     2)  ;  From:  P1(     1)  ;  Subject:  Re:kaxibrmz
P3 SEND(     1)  ;  Subject:  Re:Re:kaxibrmz
P3 RECV(     3)  ;  From:  P3(     1)  ;  Subject:  Re:Re:kaxibrmz
P3 RECV(     4)  ;  From:  P1(     2)  ;  Subject:  Re:Re:Re:kaxibrmz
P3 RECV(     5)  ;  From:  P4(     1)  ;  Subject:  hikmylas
P3 RECV(     6)  ;  From:  P2(     2)  ;  Subject:  Re:hikmylas
P3 RECV(     7)  ;  From:  P1(     3)  ;  Subject:  chlpotiv
P3 SEND(     2)  ;  Subject:  Re:chlpotiv
P3 RECV(     8)  ;  From:  P3(     2)  ;  Subject:  Re:chlpotiv
P3 RECV(     9)  ;  From:  P1(     4)  ;  Subject:  Re:Re:chlpotiv
P3 RECV(    10)  ;  From:  P4(     2)  ;  Subject:  mqcgokrl
P3 SEND(     3)  ;  Subject:  ehqrkvga
P3 RECV(    11)  ;  From:  P3(     3)  ;  Subject:  ehqrkvga

————————————————p4————————————————
P4 RECV(     1)  ;  From:  P2(     1)  ;  Subject:  kaxibrmz
P4 RECV(     2)  ;  From:  P1(     1)  ;  Subject:  Re:kaxibrmz
P4 RECV(     3)  ;  From:  P3(     1)  ;  Subject:  Re:Re:kaxibrmz
P4 RECV(     4)  ;  From:  P1(     2)  ;  Subject:  Re:Re:Re:kaxibrmz
P4 SEND(     1)  ;  Subject:  hikmylas
P4 RECV(     5)  ;  From:  P4(     1)  ;  Subject:  hikmylas
P4 RECV(     6)  ;  From:  P2(     2)  ;  Subject:  Re:hikmylas
P4 RECV(     7)  ;  From:  P1(     3)  ;  Subject:  chlpotiv
P4 RECV(     8)  ;  From:  P3(     2)  ;  Subject:  Re:chlpotiv
P4 RECV(     9)  ;  From:  P1(     4)  ;  Subject:  Re:Re:chlpotiv
P4 SEND(     2)  ;  Subject:  mqcgokrl
P4 RECV(    10)  ;  From:  P4(     2)  ;  Subject:  mqcgokrl
P4 RECV(    11)  ;  From:  P3(     3)  ;  Subject:  ehqrkvga
```

Com podem veure, en aquest cas es respecte el ordre FIFO, tots els missatges arriben en el ordre que han estat enviats.

2.1.2   1500,3000

Ara ens trobem en una situació on el temps de Jitter es major al temps d'Sleep, per tant, suposem que els missatges poden arribar desordenats als altres nodes, per tant esperem que en algun moment no es respecti el ordre FIFO.

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————————————————p1————————————————
P1 SEND(     1)  ;  Subject:  hqwifgvb
P1 RECV(     1)  ;  From:  P1(     1)  ;  Subject:  hqwifgvb
P1 SEND(     2)  ;  Subject:  fejqizvh
P1 RECV(     2)  ;  From:  P1(     2)  ;  Subject:  fejqizvh
P1 SEND(     3)  ;  Subject:  whdxkyut
P1 RECV(     3)  ;  From:  P1(     3)  ;  Subject:  whdxkyut
P1 RECV(     4)  ;  From:  P2(     1)  ;  Subject:  mieysvzb
P1 SEND(     4)  ;  Subject:  Re:mieysvzb
P1 RECV(     5)  ;  From:  P1(     4)  ;  Subject:  Re:mieysvzb
P1 SEND(     5)  ;  Subject:  ithydjog
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P1 RECV(    6)  ;  From:  P1(     5)  ;  Subject:  ithydjog
P1 RECV(    7)  ;  From:  P3(     3)  ;  Subject:  Re:phifvdrz
P1 RECV(    8)  ;  From:  P3(     2)  ;  Subject:  lcuvtkdz
P1 RECV(    9)  ;  From:  P2(     2)  ;  Subject:  jxsoadeu
P1 RECV(   10)  ;  From:  P3(     1)  ;  Subject:  cjfplkyo
P1 SEND(    6)  ;  Subject:  qtkughxe
P1 RECV(   11)  ;  From:  P1(     6)  ;  Subject:  qtkughxe
P1 RECV(   12)  ;  From:  P4(     2)  ;  Subject:  ruzntyem
P1 RECV(   13)  ;  From:  P2(     3)  ;  Subject:  ndzbrfxw
P1 RECV(   14)  ;  From:  P4(     1)  ;  Subject:  phifvdrz
P1 RECV(   15)  ;  From:  P3(     4)  ;  Subject:  Re:mieysvzb
P1 RECV(   16)  ;  From:  P4(     3)  ;  Subject:  pzcuqmxy
P1 SEND(    7)  ;  Subject:  zyuciowf
P1 RECV(   17)  ;  From:  P1(     7)  ;  Subject:  zyuciowf
P1 RECV(   18)  ;  From:  P2(     4)  ;  Subject:  cqvejgtz
P1 RECV(   19)  ;  From:  P4(     7)  ;  Subject:  fksbhwlg
P1 RECV(   20)  ;  From:  P3(     6)  ;  Subject:  hulkgsvm
P1 RECV(   21)  ;  From:  P4(     4)  ;  Subject:  havwdfsm
P1 RECV(   22)  ;  From:  P4(     9)  ;  Subject:  ijkyglrt
P1 SEND(    8)  ;  Subject:  Re:ijkyglrt

————————————————p2————————————————

P2 SEND(    1)  ;  Subject:  mieysvzb
P2 RECV(    1)  ;  From:  P2(     1)  ;  Subject:  mieysvzb
P2 RECV(    2)  ;  From:  P1(     1)  ;  Subject:  hqwifgvb
P2 RECV(    3)  ;  From:  P3(     1)  ;  Subject:  cjfplkyo
P2 SEND(    2)  ;  Subject:  jxsoadeu
P2 RECV(    4)  ;  From:  P2(     2)  ;  Subject:  jxsoadeu
P2 RECV(    5)  ;  From:  P1(     3)  ;  Subject:  whdxkyut
P2 RECV(    6)  ;  From:  P4(     1)  ;  Subject:  phifvdrz
P2 SEND(    3)  ;  Subject:  ndzbrfxw
P2 RECV(    7)  ;  From:  P2(     3)  ;  Subject:  ndzbrfxw
P2 RECV(    8)  ;  From:  P4(     2)  ;  Subject:  ruzntyem
P2 RECV(    9)  ;  From:  P3(     2)  ;  Subject:  lcuvtkdz
P2 RECV(   10)  ;  From:  P1(     5)  ;  Subject:  ithydjog
P2 RECV(   11)  ;  From:  P4(     4)  ;  Subject:  havwdfsm
P2 RECV(   12)  ;  From:  P1(     4)  ;  Subject:  Re:mieysvzb
P2 SEND(    4)  ;  Subject:  cqvejgtz
P2 RECV(   13)  ;  From:  P2(     4)  ;  Subject:  cqvejgtz
P2 RECV(   14)  ;  From:  P3(     4)  ;  Subject:  Re:mieysvzb
P2 RECV(   15)  ;  From:  P3(     5)  ;  Subject:  dgketfzq
P2 RECV(   16)  ;  From:  P3(     3)  ;  Subject:  Re:phifvdrz
P2 RECV(   17)  ;  From:  P1(     2)  ;  Subject:  fejqizvh
P2 RECV(   18)  ;  From:  P4(     5)  ;  Subject:  Re:cqvejgtz
P2 RECV(   19)  ;  From:  P4(     6)  ;  Subject:  Re:Re:mieysvzb
P2 RECV(   20)  ;  From:  P1(     7)  ;  Subject:  zyuciowf
P2 RECV(   21)  ;  From:  P4(     3)  ;  Subject:  pzcuqmxy
P2 SEND(    5)  ;  Subject:  ikxnwabr
P2 RECV(   22)  ;  From:  P2(     5)  ;  Subject:  ikxnwabr
P2 RECV(   23)  ;  From:  P1(     6)  ;  Subject:  qtkughxe
P2 SEND(    6)  ;  Subject:  woentafk
P2 RECV(   24)  ;  From:  P2(     6)  ;  Subject:  woentafk
P2 RECV(   25)  ;  From:  P4(    10)  ;  Subject:  Re:ndzbrfxw
P2 RECV(   26)  ;  From:  P3(     7)  ;  Subject:  ldqskwrc

————————————————p3————————————————

P3 SEND(    1)  ;  Subject:  cjfplkyo
P3 RECV(    1)  ;  From:  P3(     1)  ;  Subject:  cjfplkyo
P3 SEND(    2)  ;  Subject:  lcuvtkdz
P3 RECV(    2)  ;  From:  P3(     2)  ;  Subject:  lcuvtkdz
P3 RECV(    3)  ;  From:  P4(     1)  ;  Subject:  phifvdrz
P3 SEND(    3)  ;  Subject:  Re:phifvdrz
P3 RECV(    4)  ;  From:  P3(     3)  ;  Subject:  Re:phifvdrz
P3 RECV(    5)  ;  From:  P1(     1)  ;  Subject:  hqwifgvb
P3 RECV(    6)  ;  From:  P1(     2)  ;  Subject:  fejqizvh
P3 RECV(    7)  ;  From:  P2(     1)  ;  Subject:  mieysvzb
P3 SEND(    4)  ;  Subject:  Re:mieysvzb
P3 RECV(    8)  ;  From:  P3(     4)  ;  Subject:  Re:mieysvzb
P3 SEND(    5)  ;  Subject:  dgketfzq
P3 RECV(    9)  ;  From:  P3(     5)  ;  Subject:  dgketfzq
P3 RECV(   10)  ;  From:  P2(     2)  ;  Subject:  jxsoadeu
P3 SEND(    6)  ;  Subject:  hulkgsvm
P3 RECV(   11)  ;  From:  P3(     6)  ;  Subject:  hulkgsvm
P3 RECV(   12)  ;  From:  P4(     6)  ;  Subject:  Re:Re:mieysvzb
P3 RECV(   13)  ;  From:  P2(     3)  ;  Subject:  ndzbrfxw
P3 RECV(   14)  ;  From:  P4(     4)  ;  Subject:  havwdfsm
P3 RECV(   15)  ;  From:  P1(     3)  ;  Subject:  whdxkyut
P3 RECV(   16)  ;  From:  P4(     7)  ;  Subject:  fksbhwlg
P3 RECV(   17)  ;  From:  P4(     2)  ;  Subject:  ruzntyem
P3 RECV(   18)  ;  From:  P1(     5)  ;  Subject:  ithydjog
P3 RECV(   19)  ;  From:  P4(     5)  ;  Subject:  Re:cqvejgtz
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P3 RECV(  20) ; From: P1(   4) ; Subject: Re:mieysvzb
P3 RECV(  21) ; From: P1(   6) ; Subject: qtkughxe
P3 SEND(   7) ; Subject: ldqskwrc
P3 RECV(  22) ; From: P3(   7) ; Subject: ldqskwrc
P3 RECV(  23) ; From: P4(   3) ; Subject: pzcuqmxy
P3 RECV(  24) ; From: P2(   5) ; Subject: ikxnwabr
P3 RECV(  25) ; From: P2(   4) ; Subject: cqvejgtz
P3 SEND(   8) ; Subject: emrsnzau
P3 RECV(  26) ; From: P3(   8) ; Subject: emrsnzau
P3 RECV(  27) ; From: P1(   9) ; Subject: pujqhbia
P3 RECV(  28) ; From: P4(   8) ; Subject: Re:dgketfzq
P3 SEND(   9) ; Subject: rxvcupsm
P3 RECV(  29) ; From: P3(   9) ; Subject: rxvcupsm
P3 RECV(  30) ; From: P2(   7) ; Subject: Re:fksbhwlg
P3 SEND(  10) ; Subject: Re:Re:fksbhwlg
P3 RECV(  31) ; From: P3(  10) ; Subject: Re:Re:fksbhwlg
P3 RECV(  32) ; From: P1(   7) ; Subject: zyuciowf
P3 RECV(  33) ; From: P1(   8) ; Subject: Re:ijkyglrt
P3 SEND(  11) ; Subject: Re:Re:ijkyglrt
P3 RECV(  34) ; From: P3(  11) ; Subject: Re:Re:ijkyglrt
P3 RECV(  35) ; From: P4(   9) ; Subject: ijkyglrt
————————————————p4————————————————
P4 RECV(   1) ; From: P1(   1) ; Subject: hqwifgvb
P4 SEND(   1) ; Subject: phifvdrz
P4 RECV(   2) ; From: P4(   1) ; Subject: phifvdrz
P4 RECV(   3) ; From: P2(   2) ; Subject: jxsoadeu
P4 RECV(   4) ; From: P2(   1) ; Subject: mieysvzb
P4 RECV(   5) ; From: P3(   1) ; Subject: cjfplkyo
P4 RECV(   6) ; From: P1(   3) ; Subject: whdxkyut
P4 RECV(   7) ; From: P3(   3) ; Subject: Re:phifvdrz
P4 SEND(   2) ; Subject: ruzntyem
P4 RECV(   8) ; From: P4(   2) ; Subject: ruzntyem
P4 RECV(   9) ; From: P1(   2) ; Subject: fejqizvh
P4 SEND(   3) ; Subject: pzcuqmxy
P4 RECV(  10) ; From: P4(   3) ; Subject: pzcuqmxy
P4 SEND(   4) ; Subject: havwdfsm
P4 RECV(  11) ; From: P4(   4) ; Subject: havwdfsm
P4 RECV(  12) ; From: P3(   2) ; Subject: lcuvtkdz
P4 RECV(  13) ; From: P1(   5) ; Subject: ithydjog
P4 RECV(  14) ; From: P2(   4) ; Subject: cqvejgtz
P4 SEND(   5) ; Subject: Re:cqvejgtz
P4 RECV(  15) ; From: P4(   5) ; Subject: Re:cqvejgtz
P4 RECV(  16) ; From: P3(   4) ; Subject: Re:mieysvzb
P4 SEND(   6) ; Subject: Re:Re:mieysvzb
P4 RECV(  17) ; From: P4(   6) ; Subject: Re:Re:mieysvzb
P4 RECV(  18) ; From: P1(   4) ; Subject: Re:mieysvzb
P4 SEND(   7) ; Subject: fksbhwlg
P4 RECV(  19) ; From: P4(   7) ; Subject: fksbhwlg
P4 RECV(  20) ; From: P3(   5) ; Subject: dgketfzq
P4 SEND(   8) ; Subject: Re:dgketfzq
P4 RECV(  21) ; From: P4(   8) ; Subject: Re:dgketfzq
P4 RECV(  22) ; From: P1(   6) ; Subject: qtkughxe
P4 SEND(   9) ; Subject: ijkyglrt
P4 RECV(  23) ; From: P4(   9) ; Subject: ijkyglrt
P4 RECV(  24) ; From: P1(   7) ; Subject: zyuciowf
P4 RECV(  25) ; From: P2(   3) ; Subject: ndzbrfxw
P4 SEND(  10) ; Subject: Re:ndzbrfxw
P4 RECV(  26) ; From: P4(  10) ; Subject: Re:ndzbrfxw
P4 RECV(  27) ; From: P1(   9) ; Subject: pujqhbia
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La nostre hipòtesis es compleix, podem veure com s'han desordenat gran quantitat de missatges. Per posar un exemple, en el procés 2 rebem el primer missatge procedent del P1, i el segon missatge que rebem d'aquest mateix procés és el número 3, i no és fins al cap d'un temps que rebem el número 2. Per tant estem veient com rebem missatges desordenats. Això és degut a que el temps entre enviaments de nous missatges (Sleep) pot ser menor al temps que tarda un missatge en arribar al seu destí (Jitter).

2.2 Causal

i) Set up the causal order multicast system, and repeat the previous tests.

2.2.1   2000,0

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———————————————————p1———————————————————
P1 RECV(    1)  ; From: P4(    1)  ; Subject: glrdftzq
P1 RECV(    2)  ; From: P2(    1)  ; Subject: Re:glrdftzq
P1 SEND(    1)  ; Subject: gqfcmivl
P1 RECV(    3)  ; From: P1(    1)  ; Subject: gqfcmivl
P1 RECV(    4)  ; From: P2(    2)  ; Subject: Re:gqfcmivl
P1 RECV(    5)  ; From: P3(    1)  ; Subject: qjxnolvi
P1 SEND(    2)  ; Subject: Re:qjxnolvi
P1 RECV(    6)  ; From: P1(    2)  ; Subject: Re:qjxnolvi
P1 RECV(    7)  ; From: P2(    3)  ; Subject: ljscxtrp
P1 RECV(    8)  ; From: P4(    2)  ; Subject: ixgmdvkw
P1 SEND(    3)  ; Subject: Re:ixgmdvkw
P1 RECV(    9)  ; From: P1(    3)  ; Subject: Re:ixgmdvkw
P1 RECV(   10)  ; From: P3(    2)  ; Subject: Re:ixgmdvkw
P1 RECV(   11)  ; From: P4(    3)  ; Subject: Re:Re:ixgmdvkw
P1 SEND(    4)  ; Subject: xkmeazfy
P1 RECV(   12)  ; From: P1(    4)  ; Subject: xkmeazfy
P1 RECV(   13)  ; From: P3(    3)  ; Subject: Re:xkmeazfy
P1 SEND(    5)  ; Subject: Re:Re:xkmeazfy
P1 RECV(   14)  ; From: P1(    5)  ; Subject: Re:Re:xkmeazfy
P1 RECV(   15)  ; From: P2(    4)  ; Subject: uwthxkza
P1 RECV(   16)  ; From: P4(    4)  ; Subject: qknivtce
P1 SEND(    6)  ; Subject: Re:qknivtce
P1 RECV(   17)  ; From: P1(    6)  ; Subject: Re:qknivtce
P1 RECV(   18)  ; From: P3(    4)  ; Subject: stgxnozi
P1 SEND(    7)  ; Subject: Re:stgxnozi
P1 RECV(   19)  ; From: P1(    7)  ; Subject: Re:stgxnozi

———————————————————p2———————————————————
P2 RECV(    1)  ; From: P4(    1)  ; Subject: glrdftzq
P2 SEND(    1)  ; Subject: Re:glrdftzq
P2 RECV(    2)  ; From: P2(    1)  ; Subject: Re:glrdftzq
P2 RECV(    3)  ; From: P1(    1)  ; Subject: gqfcmivl
P2 SEND(    2)  ; Subject: Re:gqfcmivl
P2 RECV(    4)  ; From: P2(    2)  ; Subject: Re:gqfcmivl
P2 RECV(    5)  ; From: P3(    1)  ; Subject: qjxnolvi
P2 RECV(    6)  ; From: P1(    2)  ; Subject: Re:qjxnolvi
P2 SEND(    3)  ; Subject: ljscxtrp
P2 RECV(    7)  ; From: P2(    3)  ; Subject: ljscxtrp
P2 RECV(    8)  ; From: P4(    2)  ; Subject: ixgmdvkw
P2 RECV(    9)  ; From: P3(    2)  ; Subject: Re:ixgmdvkw
P2 RECV(   10)  ; From: P1(    3)  ; Subject: Re:ixgmdvkw
P2 RECV(   11)  ; From: P4(    3)  ; Subject: Re:Re:ixgmdvkw
P2 RECV(   12)  ; From: P1(    4)  ; Subject: xkmeazfy
P2 RECV(   13)  ; From: P3(    3)  ; Subject: Re:xkmeazfy
P2 RECV(   14)  ; From: P1(    5)  ; Subject: Re:Re:xkmeazfy
P2 SEND(    4)  ; Subject: uwthxkza
P2 RECV(   15)  ; From: P2(    4)  ; Subject: uwthxkza
P2 RECV(   16)  ; From: P4(    4)  ; Subject: qknivtce
P2 RECV(   17)  ; From: P1(    6)  ; Subject: Re:qknivtce
P2 RECV(   18)  ; From: P3(    4)  ; Subject: stgxnozi
P2 RECV(   19)  ; From: P1(    7)  ; Subject: Re:stgxnozi

———————————————————p3———————————————————
P3 RECV(    1)  ; From: P4(    1)  ; Subject: glrdftzq
P3 RECV(    2)  ; From: P2(    1)  ; Subject: Re:glrdftzq
P3 RECV(    3)  ; From: P1(    1)  ; Subject: gqfcmivl
P3 RECV(    4)  ; From: P2(    2)  ; Subject: Re:gqfcmivl
P3 SEND(    1)  ; Subject: qjxnolvi
P3 RECV(    5)  ; From: P3(    1)  ; Subject: qjxnolvi
P3 RECV(    6)  ; From: P1(    2)  ; Subject: Re:qjxnolvi
P3 RECV(    7)  ; From: P2(    3)  ; Subject: ljscxtrp
P3 RECV(    8)  ; From: P4(    2)  ; Subject: ixgmdvkw
P3 SEND(    2)  ; Subject: Re:ixgmdvkw
P3 RECV(    9)  ; From: P3(    2)  ; Subject: Re:ixgmdvkw
P3 RECV(   10)  ; From: P1(    3)  ; Subject: Re:ixgmdvkw
P3 RECV(   11)  ; From: P4(    3)  ; Subject: Re:Re:ixgmdvkw
P3 RECV(   12)  ; From: P1(    4)  ; Subject: xkmeazfy
P3 SEND(    3)  ; Subject: Re:xkmeazfy
P3 RECV(   13)  ; From: P3(    3)  ; Subject: Re:xkmeazfy
P3 RECV(   14)  ; From: P1(    5)  ; Subject: Re:Re:xkmeazfy
P3 RECV(   15)  ; From: P2(    4)  ; Subject: uwthxkza
P3 RECV(   16)  ; From: P4(    4)  ; Subject: qknivtce
P3 RECV(   17)  ; From: P1(    6)  ; Subject: Re:qknivtce
P3 SEND(    4)  ; Subject: stgxnozi
P3 RECV(   18)  ; From: P3(    4)  ; Subject: stgxnozi
P3 RECV(   19)  ; From: P1(    7)  ; Subject: Re:stgxnozi

———————————————————p4———————————————————
P4 SEND(    1)  ; Subject: glrdftzq
P4 RECV(    1)  ; From: P4(    1)  ; Subject: glrdftzq
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P4 RECV(    2)  ;  From:  P2(    1)  ;  Subject:  Re:glrdftzq
P4 RECV(    3)  ;  From:  P1(    1)  ;  Subject:  gqfcmivl
P4 RECV(    4)  ;  From:  P2(    2)  ;  Subject:  Re:gqfcmivl
P4 RECV(    5)  ;  From:  P3(    1)  ;  Subject:  qjxnolvi
P4 RECV(    6)  ;  From:  P1(    2)  ;  Subject:  Re:qjxnolvi
P4 RECV(    7)  ;  From:  P2(    3)  ;  Subject:  ljscxtrp
P4 SEND(    2)  ;  Subject:  ixgmdvkw
P4 RECV(    8)  ;  From:  P4(    2)  ;  Subject:  ixgmdvkw
P4 RECV(    9)  ;  From:  P3(    2)  ;  Subject:  Re:ixgmdvkw
P4 SEND(    3)  ;  Subject:  Re:Re:ixgmdvkw
P4 RECV(   10)  ;  From:  P1(    3)  ;  Subject:  Re:ixgmdvkw
P4 RECV(   11)  ;  From:  P4(    3)  ;  Subject:  Re:Re:ixgmdvkw
P4 RECV(   12)  ;  From:  P1(    4)  ;  Subject:  xkmeazfy
P4 RECV(   13)  ;  From:  P3(    3)  ;  Subject:  Re:xkmeazfy
P4 RECV(   14)  ;  From:  P1(    5)  ;  Subject:  Re:Re:xkmeazfy
P4 RECV(   15)  ;  From:  P2(    4)  ;  Subject:  uwthxkza
P4 SEND(    4)  ;  Subject:  qknivtce
P4 RECV(   16)  ;  From:  P4(    4)  ;  Subject:  qknivtce
P4 RECV(   17)  ;  From:  P1(    6)  ;  Subject:  Re:qknivtce
P4 RECV(   18)  ;  From:  P3(    4)  ;  Subject:  stgxnozi
P4 RECV(   19)  ;  From:  P1(    7)  ;  Subject:  Re:stgxnozi
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2.2.2   1500,3000

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—————————————————————————p1—————————————————————————
P1 SEND(    1)  ;  Subject:  gtvsdqxh
P1 RECV(    1)  ;  From:  P1(    1)  ;  Subject:  gtvsdqxh
P1 RECV(    2)  ;  From:  P3(    1)  ;  Subject:  jrhqvfsz
P1 SEND(    2)  ;  Subject:  wsitrdun
P1 RECV(    3)  ;  From:  P1(    2)  ;  Subject:  wsitrdun
P1 RECV(    4)  ;  From:  P4(    1)  ;  Subject:  knisfjve
P1 RECV(    5)  ;  From:  P3(    2)  ;  Subject:  Re:gtvsdqxh
P1 SEND(    3)  ;  Subject:  cfmbawok
P1 RECV(    6)  ;  From:  P1(    3)  ;  Subject:  cfmbawok
P1 SEND(    4)  ;  Subject:  ioudnxzy
P1 RECV(    7)  ;  From:  P1(    4)  ;  Subject:  ioudnxzy
P1 RECV(    8)  ;  From:  P3(    3)  ;  Subject:  evgjrfnh
P1 SEND(    5)  ;  Subject:  lqzjtunf
P1 RECV(    9)  ;  From:  P1(    5)  ;  Subject:  lqzjtunf
P1 SEND(    6)  ;  Subject:  gldbywxn
P1 RECV(   10)  ;  From:  P1(    6)  ;  Subject:  gldbywxn
P1 RECV(   11)  ;  From:  P2(    1)  ;  Subject:  qdoriubk
P1 RECV(   12)  ;  From:  P2(    2)  ;  Subject:  xfkqiyad


—————————————————————————p2—————————————————————————
P2 RECV(    1)  ;  From:  P1(    1)  ;  Subject:  gtvsdqxh
P2 SEND(    1)  ;  Subject:  qdoriubk
P2 RECV(    2)  ;  From:  P2(    1)  ;  Subject:  qdoriubk
P2 RECV(    3)  ;  From:  P3(    1)  ;  Subject:  jrhqvfsz
P2 SEND(    2)  ;  Subject:  xfkqiyad
P2 RECV(    4)  ;  From:  P2(    2)  ;  Subject:  xfkqiyad
P2 SEND(    3)  ;  Subject:  plxwkbvt
P2 RECV(    5)  ;  From:  P2(    3)  ;  Subject:  plxwkbvt
P2 RECV(    6)  ;  From:  P3(    2)  ;  Subject:  Re:gtvsdqxh
P2 RECV(    7)  ;  From:  P3(    3)  ;  Subject:  evgjrfnh
P2 SEND(    4)  ;  Subject:  mpcvfowt
P2 RECV(    8)  ;  From:  P2(    4)  ;  Subject:  mpcvfowt
P2 RECV(    9)  ;  From:  P3(    4)  ;  Subject:  wtrsjxhp
P2 SEND(    5)  ;  Subject:  dloyvftq
P2 RECV(   10)  ;  From:  P2(    5)  ;  Subject:  dloyvftq
P2 RECV(   11)  ;  From:  P4(    1)  ;  Subject:  knisfjve
P2 RECV(   12)  ;  From:  P4(    2)  ;  Subject:  esifdobn
P2 RECV(   13)  ;  From:  P4(    3)  ;  Subject:  ldoqhstc
P2 RECV(   14)  ;  From:  P4(    4)  ;  Subject:  bonujzis
P2 RECV(   15)  ;  From:  P1(    2)  ;  Subject:  wsitrdun


—————————————————————————p3—————————————————————————
P3 SEND(    1)  ;  Subject:  jrhqvfsz
P3 RECV(    1)  ;  From:  P3(    1)  ;  Subject:  jrhqvfsz
P3 RECV(    2)  ;  From:  P1(    1)  ;  Subject:  gtvsdqxh
P3 SEND(    2)  ;  Subject:  Re:gtvsdqxh
P3 RECV(    3)  ;  From:  P3(    2)  ;  Subject:  Re:gtvsdqxh
P3 SEND(    3)  ;  Subject:  evgjrfnh
P3 RECV(    4)  ;  From:  P3(    3)  ;  Subject:  evgjrfnh
P3 SEND(    4)  ;  Subject:  wtrsjxhp
P3 RECV(    5)  ;  From:  P3(    4)  ;  Subject:  wtrsjxhp
P3 RECV(    6)  ;  From:  P4(    1)  ;  Subject:  knisfjve
P3 SEND(    5)  ;  Subject:  Re:knisfjve
P3 RECV(    7)  ;  From:  P3(    5)  ;  Subject:  Re:knisfjve
P3 RECV(    8)  ;  From:  P4(    2)  ;  Subject:  esifdobn
P3 SEND(    6)  ;  Subject:  Re:esifdobn
P3 RECV(    9)  ;  From:  P3(    6)  ;  Subject:  Re:esifdobn
P3 SEND(    7)  ;  Subject:  drwxjkvb
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P3 RECV(   10) ; From: P3(    7) ; Subject: drwxjkvb
P3 SEND(    8) ; Subject: lxbynuda
P3 RECV(   11) ; From: P3(    8) ; Subject: lxbynuda
P3 SEND(    9) ; Subject: phbgdxly
P3 RECV(   12) ; From: P3(    9) ; Subject: phbgdxly
P3 RECV(   13) ; From: P4(    3) ; Subject: ldoqhstc
P3 RECV(   14) ; From: P2(    1) ; Subject: qdoriubk
P3 RECV(   15) ; From: P2(    2) ; Subject: xfkqiyad
P3 RECV(   16) ; From: P2(    3) ; Subject: plxwkbvt

————————————————p4————————————————
P4 RECV(    1) ; From: P1(    1) ; Subject: gtvsdqxh
P4 SEND(    1) ; Subject: knisfjve
P4 RECV(    2) ; From: P4(    1) ; Subject: knisfjve
P4 SEND(    2) ; Subject: esifdobn
P4 RECV(    3) ; From: P4(    2) ; Subject: esifdobn
P4 SEND(    3) ; Subject: ldoqhstc
P4 RECV(    4) ; From: P4(    3) ; Subject: ldoqhstc
P4 SEND(    4) ; Subject: bonujzis
P4 RECV(    5) ; From: P4(    4) ; Subject: bonujzis
P4 SEND(    5) ; Subject: gcawmdlo
P4 RECV(    6) ; From: P4(    5) ; Subject: gcawmdlo
P4 RECV(    7) ; From: P3(    1) ; Subject: jrhqvfsz
P4 SEND(    8) ; From: P1(    2) ; Subject: wsitrdun
P4 RECV(    9) ; From: P3(    2) ; Subject: Re:gtvsdqxh
P4 SEND(    6) ; Subject: mixdruqz
P4 RECV(   10) ; From: P4(    6) ; Subject: mixdruqz
P4 RECV(   11) ; From: P2(    1) ; Subject: qdoriubk
P4 SEND(    7) ; Subject: qvwemupr
P4 RECV(   12) ; From: P4(    7) ; Subject: qvwemupr
P4 SEND(    8) ; Subject: dmyqrohk
P4 RECV(   13) ; From: P4(    8) ; Subject: dmyqrohk
P4 SEND(    9) ; Subject: elwomuya
P4 RECV(   14) ; From: P4(    9) ; Subject: elwomuya
P4 RECV(   15) ; From: P1(    3) ; Subject: cfmbawok
P4 SEND(   10) ; Subject: Re:cfmbawok
P4 RECV(   16) ; From: P4(   10) ; Subject: Re:cfmbawok
P4 SEND(   11) ; Subject: kuidshqb
P4 RECV(   17) ; From: P4(   11) ; Subject: kuidshqb
```

Amb la implementació d'aquesta versió podem veure com efectivament es compleix que l'ordre en els missatges que estan relacionats entre si, és a dir, cap instància d'erlang mai entregarà les contestacions d'un missatge abans que el propi missatge.

2.3   Total

i) Set up the total order multicast system, and repeat the previous tests.

2.3.1   2000,0

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————————p1————————————————
P1 RECV(    1) ; From: P4(    1) ; Subject: oawtzpmh
P1 SEND(    1) ; Subject: rzwxofvs
P1 RECV(    2) ; From: P1(    1) ; Subject: rzwxofvs
P1 RECV(    3) ; From: P3(    1) ; Subject: stdcmyeo
P1 SEND(    2) ; Subject: vwbdckoa
P1 RECV(    4) ; From: P1(    2) ; Subject: vwbdckoa
P1 RECV(    5) ; From: P2(    1) ; Subject: mvwhegir
P1 SEND(    3) ; Subject: Re:mvwhegir
P1 RECV(    6) ; From: P3(    2) ; Subject: Re:mvwhegir
P1 SEND(    4) ; Subject: Re:Re:mvwhegir
P1 RECV(    7) ; From: P1(    3) ; Subject: Re:mvwhegir
P1 RECV(    8) ; From: P2(    2) ; Subject: Re:Re:mvwhegir
P1 RECV(    9) ; From: P1(    4) ; Subject: Re:Re:mvwhegir
P1 RECV(   10) ; From: P3(    3) ; Subject: Re:Re:mvwhegir
P1 RECV(   11) ; From: P2(    3) ; Subject: Re:Re:mvwhegir
P1 RECV(   12) ; From: P4(    2) ; Subject: Re:Re:Re:mvwhegir
P1 SEND(    5) ; Subject: gazdpvmr
P1 RECV(   13) ; From: P1(    5) ; Subject: gazdpvmr
P1 RECV(   14) ; From: P4(    3) ; Subject: Re:gazdpvmr
P1 RECV(   15) ; From: P3(    4) ; Subject: iklwxfbe
P1 RECV(   16) ; From: P4(    4) ; Subject: fgkjlenm
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P1 RECV(   17) ; From: P3(    5) ; Subject: qcposgdu
P1 RECV(   18) ; From: P2(    4) ; Subject: Re:qcposgdu
P1 RECV(   19) ; From: P3(    6) ; Subject: Re:Re:qcposgdu
P1 SEND(    6) ; Subject: Re:Re:Re:qcposgdu
P1 RECV(   20) ; From: P2(    5) ; Subject: upmwshcq
P1 RECV(   21) ; From: P1(    6) ; Subject: Re:Re:Re:qcposgdu
P1 RECV(   22) ; From: P2(    6) ; Subject: tykpqzin
P1 SEND(    7) ; Subject: Re:tykpqzin
P1 RECV(   23) ; From: P1(    7) ; Subject: Re:tykpqzin
P1 RECV(   24) ; From: P2(    7) ; Subject: Re:Re:tykpqzin
P1 RECV(   25) ; From: P4(    5) ; Subject: Re:Re:Re:tykpqzin
P1 RECV(   26) ; From: P2(    8) ; Subject: gmyqwiab
P1 RECV(   27) ; From: P2(    9) ; Subject: qlyzbjgf
P1 SEND(    8) ; Subject: Re:qlyzbjgf
P1 RECV(   28) ; From: P1(    8) ; Subject: Re:qlyzbjgf
P1 RECV(   29) ; From: P2(   10) ; Subject: Re:Re:qlyzbjgf
P1 RECV(   30) ; From: P4(    6) ; Subject: labyrdkj
P1 SEND(    9) ; Subject: aezdyhmf
P1 RECV(   31) ; From: P1(    9) ; Subject: aezdyhmf
P1 RECV(   32) ; From: P3(    7) ; Subject: hftnpews


————————————p2————————————
P2 RECV(    1) ; From: P4(    1) ; Subject: oawtzpmh
P2 RECV(    2) ; From: P1(    1) ; Subject: rzwxofvs
P2 RECV(    3) ; From: P3(    1) ; Subject: stdcmyeo
P2 RECV(    4) ; From: P1(    2) ; Subject: vwbdckoa
P2 SEND(    1) ; Subject: mvwhegir
P2 RECV(    5) ; From: P2(    1) ; Subject: mvwhegir
P2 RECV(    6) ; From: P3(    2) ; Subject: Re:mvwhegir
P2 SEND(    2) ; Subject: Re:Re:mvwhegir
P2 RECV(    7) ; From: P1(    3) ; Subject: Re:mvwhegir
P2 SEND(    3) ; Subject: Re:Re:mvwhegir
P2 RECV(    8) ; From: P2(    2) ; Subject: Re:Re:mvwhegir
P2 RECV(    9) ; From: P1(    4) ; Subject: Re:Re:mvwhegir
P2 RECV(   10) ; From: P3(    3) ; Subject: Re:Re:mvwhegir
P2 RECV(   11) ; From: P2(    3) ; Subject: Re:Re:mvwhegir
P2 RECV(   12) ; From: P4(    2) ; Subject: Re:Re:Re:mvwhegir
P2 RECV(   13) ; From: P1(    5) ; Subject: gazdpvmr
P2 RECV(   14) ; From: P4(    3) ; Subject: Re:gazdpvmr
P2 RECV(   15) ; From: P3(    4) ; Subject: iklwxfbe
P2 RECV(   16) ; From: P4(    4) ; Subject: fgkjlenm
P2 RECV(   17) ; From: P3(    5) ; Subject: qcposgdu
P2 SEND(    4) ; Subject: Re:qcposgdu
P2 RECV(   18) ; From: P2(    4) ; Subject: Re:qcposgdu
P2 SEND(    5) ; Subject: upmwshcq
P2 RECV(   19) ; From: P3(    6) ; Subject: Re:Re:qcposgdu
P2 RECV(   20) ; From: P2(    5) ; Subject: upmwshcq
P2 RECV(   21) ; From: P1(    6) ; Subject: Re:Re:Re:qcposgdu
P2 SEND(    6) ; Subject: tykpqzin
P2 RECV(   22) ; From: P2(    6) ; Subject: tykpqzin
P2 RECV(   23) ; From: P1(    7) ; Subject: Re:tykpqzin
P2 SEND(    7) ; Subject: Re:Re:tykpqzin
P2 RECV(   24) ; From: P2(    7) ; Subject: Re:Re:tykpqzin
P2 RECV(   25) ; From: P4(    5) ; Subject: Re:Re:Re:tykpqzin
P2 SEND(    8) ; Subject: gmyqwiab
P2 RECV(   26) ; From: P2(    8) ; Subject: gmyqwiab
P2 SEND(    9) ; Subject: qlyzbjgf
P2 RECV(   27) ; From: P2(    9) ; Subject: qlyzbjgf
P2 RECV(   28) ; From: P1(    8) ; Subject: Re:qlyzbjgf
P2 SEND(   10) ; Subject: Re:Re:qlyzbjgf
P2 RECV(   29) ; From: P2(   10) ; Subject: Re:Re:qlyzbjgf
P2 RECV(   30) ; From: P4(    6) ; Subject: labyrdkj
P2 RECV(   31) ; From: P1(    9) ; Subject: aezdyhmf
P2 RECV(   32) ; From: P3(    7) ; Subject: hftnpews


————————————p3————————————
P3 RECV(    1) ; From: P4(    1) ; Subject: oawtzpmh
P3 RECV(    2) ; From: P1(    1) ; Subject: rzwxofvs
P3 SEND(    1) ; Subject: stdcmyeo
P3 RECV(    3) ; From: P3(    1) ; Subject: stdcmyeo
P3 RECV(    4) ; From: P1(    2) ; Subject: vwbdckoa
P3 RECV(    5) ; From: P2(    1) ; Subject: mvwhegir
P3 SEND(    2) ; Subject: Re:mvwhegir
P3 RECV(    6) ; From: P3(    2) ; Subject: Re:mvwhegir
P3 RECV(    7) ; From: P1(    3) ; Subject: Re:mvwhegir
P3 SEND(    3) ; Subject: Re:Re:mvwhegir
P3 RECV(    8) ; From: P2(    2) ; Subject: Re:Re:mvwhegir
P3 RECV(    9) ; From: P1(    4) ; Subject: Re:Re:mvwhegir
P3 RECV(   10) ; From: P3(    3) ; Subject: Re:Re:mvwhegir
P3 RECV(   11) ; From: P2(    3) ; Subject: Re:Re:mvwhegir
P3 RECV(   12) ; From: P4(    2) ; Subject: Re:Re:Re:mvwhegir
P3 RECV(   13) ; From: P1(    5) ; Subject: gazdpvmr
P3 RECV(   14) ; From: P4(    3) ; Subject: Re:gazdpvmr
P3 SEND(    4) ; Subject: iklwxfbe
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P3 RECV(    15)  ;  From: P3(      4)  ;  Subject:  iklwxfbe
P3 RECV(    16)  ;  From: P4(      4)  ;  Subject:  fgkjlenm
P3 SEND(      5)  ;  Subject:  qcposgdu
P3 RECV(    17)  ;  From: P3(      5)  ;  Subject:  qcposgdu
P3 RECV(    18)  ;  From: P2(      4)  ;  Subject:  Re:qcposgdu
P3 SEND(      6)  ;  Subject:  Re:Re:qcposgdu
P3 RECV(    19)  ;  From: P3(      6)  ;  Subject:  Re:Re:qcposgdu
P3 RECV(    20)  ;  From: P2(      5)  ;  Subject:  upmwshcq
P3 RECV(    21)  ;  From: P1(      6)  ;  Subject:  Re:Re:Re:qcposgdu
P3 RECV(    22)  ;  From: P2(      6)  ;  Subject:  tykpqzin
P3 RECV(    23)  ;  From: P1(      7)  ;  Subject:  Re:tykpqzin
P3 RECV(    24)  ;  From: P2(      7)  ;  Subject:  Re:Re:tykpqzin
P3 RECV(    25)  ;  From: P4(      5)  ;  Subject:  Re:Re:Re:tykpqzin
P3 RECV(    26)  ;  From: P2(      8)  ;  Subject:  gmyqwiab
P3 RECV(    27)  ;  From: P2(      9)  ;  Subject:  qlyzbjgf
P3 RECV(    28)  ;  From: P1(      8)  ;  Subject:  Re:qlyzbjgf
P3 RECV(    29)  ;  From: P2(    10)  ;  Subject:  Re:Re:qlyzbjgf
P3 RECV(    30)  ;  From: P4(      6)  ;  Subject:  labyrdkj
P3 RECV(    31)  ;  From: P1(      9)  ;  Subject:  aezdyhmf
P3 SEND(      7)  ;  Subject:  hftnpews
P3 RECV(    32)  ;  From: P3(      7)  ;  Subject:  hftnpews

————————————————p4–.————————————————
P4 SEND(      1)  ;  Subject:  oawtzpmh
P4 RECV(      1)  ;  From: P4(      1)  ;  Subject:  oawtzpmh
P4 RECV(      2)  ;  From: P1(      1)  ;  Subject:  rzwxofvs
P4 RECV(      3)  ;  From: P3(      1)  ;  Subject:  stdcmyeo
P4 RECV(      4)  ;  From: P1(      2)  ;  Subject:  vwbdckoa
P4 RECV(      5)  ;  From: P2(      1)  ;  Subject:  mvwhegir
P4 RECV(      6)  ;  From: P3(      2)  ;  Subject:  Re:mvwhegir
P4 RECV(      7)  ;  From: P1(      3)  ;  Subject:  Re:mvwhegir
P4 RECV(      8)  ;  From: P2(      2)  ;  Subject:  Re:Re:mvwhegir
P4 RECV(      9)  ;  From: P1(      4)  ;  Subject:  Re:Re:mvwhegir
P4 RECV(    10)  ;  From: P3(      3)  ;  Subject:  Re:Re:mvwhegir
P4 RECV(    11)  ;  From: P2(      3)  ;  Subject:  Re:Re:mvwhegir
P4 SEND(      2)  ;  Subject:  Re:Re:Re:mvwhegir
P4 RECV(    12)  ;  From: P4(      2)  ;  Subject:  Re:Re:Re:mvwhegir
P4 RECV(    13)  ;  From: P1(      5)  ;  Subject:  gazdpvmr
P4 SEND(      3)  ;  Subject:  Re:gazdpvmr
P4 RECV(    14)  ;  From: P4(      3)  ;  Subject:  Re:gazdpvmr
P4 RECV(    15)  ;  From: P3(      4)  ;  Subject:  iklwxfbe
P4 SEND(      4)  ;  Subject:  fgkjlenm
P4 RECV(    16)  ;  From: P4(      4)  ;  Subject:  fgkjlenm
P4 RECV(    17)  ;  From: P3(      5)  ;  Subject:  qcposgdu
P4 RECV(    18)  ;  From: P2(      4)  ;  Subject:  Re:qcposgdu
P4 RECV(    19)  ;  From: P3(      6)  ;  Subject:  Re:Re:qcposgdu
P4 RECV(    20)  ;  From: P2(      5)  ;  Subject:  upmwshcq
P4 RECV(    21)  ;  From: P1(      6)  ;  Subject:  Re:Re:Re:qcposgdu
P4 RECV(    22)  ;  From: P2(      6)  ;  Subject:  tykpqzin
P4 RECV(    23)  ;  From: P1(      7)  ;  Subject:  Re:tykpqzin
P4 RECV(    24)  ;  From: P2(      7)  ;  Subject:  Re:Re:tykpqzin
P4 SEND(      5)  ;  Subject:  Re:Re:Re:tykpqzin
P4 RECV(    25)  ;  From: P4(      5)  ;  Subject:  Re:Re:Re:tykpqzin
P4 RECV(    26)  ;  From: P2(      8)  ;  Subject:  gmyqwiab
P4 RECV(    27)  ;  From: P2(      9)  ;  Subject:  qlyzbjgf
P4 RECV(    28)  ;  From: P1(      8)  ;  Subject:  Re:qlyzbjgf
P4 RECV(    29)  ;  From: P2(    10)  ;  Subject:  Re:Re:qlyzbjgf
P4 SEND(      6)  ;  Subject:  labyrdkj
P4 RECV(    30)  ;  From: P4(      6)  ;  Subject:  labyrdkj
P4 RECV(    31)  ;  From: P1(      9)  ;  Subject:  aezdyhmf
P4 RECV(    32)  ;  From: P3(      7)  ;  Subject:  hftnpews
```

2.3.2   1500,3000

```
————————————————p1————————————————
P1 SEND(      1)  ;  Subject:  bthrxwqu
P1 SEND(      2)  ;  Subject:  dfquaevy
P1 SEND(      3)  ;  Subject:  xkmypwvu
P1 RECV(      1)  ;  From: P2(      3)  ;  Subject:  ivsmaqbg
P1 RECV(      2)  ;  From: P3(      1)  ;  Subject:  zvlbefxu

————————————————p2————————————————
P2 SEND(      1)  ;  Subject:  prtmshiu
P2 SEND(      2)  ;  Subject:  chmkdqlu
P2 SEND(      3)  ;  Subject:  ivsmaqbg
P2 SEND(      4)  ;  Subject:  zxoavjgi
P2 SEND(      5)  ;  Subject:  bnfkuheg
P2 RECV(      1)  ;  From: P2(      3)  ;  Subject:  ivsmaqbg
P2 SEND(      6)  ;  Subject:  typxwulq

————————————————p3————————————————
P3 SEND(      1)  ;  Subject:  zvlbefxu
P3 SEND(      2)  ;  Subject:  egldrnim
```

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P3 SEND(    3) ; Subject: gvlkzatq
P3 RECV(    1) ; From: P2(    3) ; Subject: ivsmaqbg
P3 RECV(    2) ; From: P3(    1) ; Subject: zvlbefxu
P3 RECV(    3) ; From: P2(    1) ; Subject: prtmshiu
P3 RECV(    4) ; From: P4(    1) ; Subject: nbaiuhlp
P3 RECV(    5) ; From: P2(    2) ; Subject: chmkdqlu
P3 RECV(    6) ; From: P4(    2) ; Subject: wtxdvfln
P3 RECV(    7) ; From: P1(    1) ; Subject: bthrxwqu

———————————————p4———————————————
P4 SEND(    1) ; Subject: nbaiuhlp
P4 SEND(    2) ; Subject: wtxdvfln
P4 SEND(    3) ; Subject: fjrmqkvs
P4 SEND(    4) ; Subject: dfknrcvq
P4 RECV(    1) ; From: P2(    3) ; Subject: ivsmaqbg
P4 RECV(    2) ; From: P3(    1) ; Subject: zvlbefxu
P4 RECV(    3) ; From: P2(    1) ; Subject: prtmshiu
P4 RECV(    4) ; From: P4(    1) ; Subject: nbaiuhlp
P4 RECV(    5) ; From: P2(    2) ; Subject: chmkdqlu
P4 SEND(    5) ; Subject: cqrwhkug
```

ii) We have a lot of messages in the system. Derive a theoretical quantification of the number of messages needed to deliver a multicast message as a function of the number of workers and check experimentally that your formulation is correct (you can modify the source code as needed to count the messages)

Per a cada missatge, el mètode total, consumeix un nombre de missatge de sincronització per tal de poder finalment mostrar el missatge original. Podem deduïr-ne la fòrmula com :

$$TotalMessages = 1_{SEND} + nodes * 1_{MULTICAST}$$
$$+nodes * 1_{PROPOSAL} + nodes * 1_{AGREED} + nodes * 1_{DELIVER} \tag{1}$$

iii) Compare with the basic multicastimplementation regarding the number of messages needed.

Per a cada missatge, el mètode bàsic, a diferència del total, consumeix un nombre de missatges inferior per a finalment mostrar el missatge original. Podem dir que la fòrmula és :

$$BasicMessages = 1_{SEND} + nodes * 1_{MULTICAST}$$
$$+nodes * 1_{DELIVER} \tag{2}$$

3 Open questions

3.1 Basic

Are the posts displayed in FIFO, causal, and total order? Justify why?

No es compleix cap dels tres ordres. Com hem pogut veure en l'apartat anterior dels experiments, forçant un temps de Jitter major que el temps d'Sleep ens trobem que no es compleix ni una ordenació FIFO, per tant tampoc estarem complint ordenacions causals ni totals.

3.2 Causal

Are the posts displayed in FIFO, causal, and total order? Justify why.

Podem observar l'ordre FIFO i el causal, però no podrem assegurar mai que quan s'envïin dos missatges no relacionats entre si (des de nodes diferents), es rebin en l'ordre real d'enviament (simplement correrà a la sort de la xarxa o altres factors donats en aquella situació i precís moment).

3.3 Total

Are the posts displayed in FIFO, causal, and total order? Justify why.
Sí, tal i com es pot veure en els extractes dels diferents processos, podem observar que cada procés els mostra tant en ordre d'arribada com en ordre total.

4 Personal opinion

Amb aquesta pràctica hem aconseguit entendre i plasmar en codi tres maneres d'ordenació de missatges multicast que havíem vist prèviament a teoria. Hem necessitat mirar un altre cop els algorismes de cada una d'aquestes ordenacions, fet que ens ha ajudat a consolidar els conceptes necessaris per entendre-ho. Creiem que ha sigut una molt bona pràctica per entendre aquest apartat de teoria, i per tant considerem que hauria de ser inclosa en el curs vinent.