Quiz on Lesson 2

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Question 1. Scientifically, our conclusions should not depend on the units of measurement we use, but we can make errors if we don't get the details right. Suppose our data are two years of weekly aggregated case reports of a disease and we have a continuous-time model solved numerically by an Euler timestep of size dt. Which of the following is a correct explanation of our options for properly implementing this in a pomp object called `po`?

(A) The measurement times, `time(po)`, should be in units of weeks, such as $1, 2, \ldots, 104$. The latent process can be modeled using arbitrary time units, say days or weeks or years. The units of dt should match the time units of the **latent** process.

(B) The measurement times, `time(po)`, should be in units of weeks, such as $1, 2, \ldots, 104$. The latent process can be modeled using arbitrary time units, say days or weeks or years. The units of dt should be in weeks (in practice, usually a fraction of a week) to match the units of the **measurement** times.

(C) The measurement times do not have to be in units of weeks. For example, we could use `time(po)`$=1/52$, $2/52, \ldots, 2$. The latent process and dt should use the same units of time as the measurement times.

(D) The measurement times do not have to be in units of weeks. For example, we could use `time(po)`$=1/52$, $2/52, \ldots, 2$. The latent process can also use arbitrary units of time, which do not necessarily match the units of the measurement times. The units of dt should match the units used for the **latent** process.

(E) The measurement times do not have to be in units of weeks. For example, we could use `time(po)`$=1/52$, $2/52, \ldots, 2$. The latent process can also use arbitrary units of time, which do not necessarily match the units of the measurement times. The units of dt should match the units used for the **measurement** times.

Question 2. Suppose you obtain the following error message when you build your pomp model using C snippets.

```
Error: error in building shared-object library from C snippets: in 'Cbuilder': compilation error:
 cannot compile shared-object library
 '/tmp/RtmpFkkeCQ/24104/pomp_068eedfcaf62b1e391363bbdd99fbe8c.so': status = 1
compiler messages:
gcc -I"/usr/local/apps/R/ubuntu_20.04/4.2.1/lib64/R/include" -DNDEBUG
-I'/home/kingaa/R/x86_64-pc-linux-gnu-library/4.2/pomp/include' -I'/home/kingaa/teach/sbied'
  -I/usr/local/include   -fpic  -g -O2 -Wall -pedantic
-c /tmp/RtmpFkkeCQ/24104/pomp_068eedfcaf62b1e391363bbdd99fbe8c.c
-o /tmp/RtmpFkkeCQ/24104/pomp_068eedfcaf62b1e391363bbdd99fbe8c.o
/tmp/RtmpFkkeCQ/24104/pomp_068eedfcaf62b1e391363bbdd99fbe8c.c:
In function '__pomp_rinit':
/tmp/RtmpFkkeCQ/24104/pomp_068eedfcaf62b1e391363bbdd99fbe8c.c:38:13:
 error: called object is not a function or function pointer
  38 |      cases = 0
     |              ^
make: *** [/usr/local/apps/R/ubuntu_20.04/4.2.1/lib64/R/etc/Makeconf:168:
 /tmp/RtmpFkkeCQ/24104/pomp_068eedfcaf62b1e391363bbdd99fbe8c.o] Error 1
In addition: Warning message:
In system2(command = R.home("bin/R"), args = c("CMD", "SHLIB", "-c",  :
  running command 'PKG_CPPFLAGS="-I'/home/kingaa/R/x86_64-pc-linux-gnu-library/4.2/pomp/include'
 -I'/home/kingaa/teach/sbied'" '/usr/local/apps/R/ubuntu_20.04/4.2.1/lib64/R/bin/R' CMD SHLIB -c
 -o /tmp/RtmpFkkeCQ/24104/pomp_068eedfcaf62b1e391363bbdd99fbe8c.so
 /tmp/RtmpFkkeCQ/24104/pomp_068eedfcaf62b1e391363bbdd99fbe8c.c 2>&1' had status 1
```

Which of the following is a plausible cause for this error?

(A) Using R syntax within a C function that has the same name as an R function.

(B) A parameter is missing from the `paramnames` argument to `pomp`.

(C) Indexing past the end of an array because C labels indices starting at 0.

(D) Using `beta` as a parameter name when it is a declared C function.

(E) A missing semicolon at the end of a line.

Question 3. Suppose you obtain the following error message when you build your pomp model using C snippets.

```
Error: error in building shared-object library from C snippets: in 'Cbuilder': compilation error:
cannot compile shared-object library '/var/folders/fv/pt62sh2d6_gf9fp3t7b466vr0000gr/T//RtmpD16GmG/
5324/pomp_b675d99e691eda865610f570058ea3be.so': status = 1
compiler messages:
clang -mmacosx-version-min=10.13 -I"/Library/Frameworks/R.framework/Resources/include" -DNDEBUG
-I'/Users/ionides/Library/R/x86_64/4.1/library/pomp/include' -I'/Users/ionides/sbied/questions'
-I/usr/local/include   -fPIC  -Wall -g -O2
-c /var/folders/fv/pt62sh2d6_gf9fp3t7b466vr0000gr/T//RtmpD16GmG/
5324/pomp_b675d99e691eda865610f570058ea3be.c
-o /var/folders/fv/pt62sh2d6_gf9fp3t7b466vr0000gr/T//RtmpD16GmG/
5324/pomp_b675d99e691eda865610f570058ea3be.o
/var/folders/fv/pt62sh2d6_gf9fp3t7b466vr0000gr/T//RtmpD16GmG/
5324/pomp_b675d99e691eda865610f570058ea3be.c:33:16:
error: use of undeclared identifier 'pop'; did you mean 'pow'?
    double m = pop/(S_0+I_0+R_0);
               ^~~
               pow
/Applications/
In addition: Warning message:
In system2(command = R.home("bin/R"), args = c("CMD", "SHLIB", "-c",   :
  running command 'PKG_CPPFLAGS="-I'/Users/ionides/Library/R/x86_64/4.1/library/pomp/include'
-I'/Users/ionides/sbied/questions'" '/Library/Frameworks/R.framework/Resources/bin/R' CMD SHLIB
-c -o /var/folders/fv/pt62sh2d6_gf9fp3t7b466vr0000gr/T//RtmpD16GmG/
5324/pomp_b675d99e691eda865610f570058ea3be.so
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(D) Using `beta` as a parameter name when it is a declared C function.

(E) A missing semicolon at the end of a line.

Question 4. Suppose you obtain the following error message when you build your pomp model using C snippets.

```
Error: in 'simulate': error in building shared-object library from C snippets: in 'Cbuilder':
 compilation error: cannot compile shared-object library
 '/tmp/RtmpFkkeCQ/24104/pomp_4fc43714a7a9ebddf896bbc51635d211.so': status = 1
compiler messages:
gcc -I"/usr/local/apps/R/ubuntu_20.04/4.2.1/lib64/R/include" -DNDEBUG
 -I'/home/kingaa/R/x86_64-pc-linux-gnu-library/4.2/pomp/include' -I'/home/kingaa/teach/sbied'
  -I/usr/local/include   -fpic  -g -O2 -Wall -pedantic -c
/tmp/RtmpFkkeCQ/24104/pomp_4fc43714a7a9ebddf896bbc51635d211.c
-o /tmp/RtmpFkkeCQ/24104/pomp_4fc43714a7a9ebddf896bbc51635d211.o
In file included from /home/kingaa/R/x86_64-pc-linux-gnu-library/4.2/pomp/include/pomp.h:9,
                 from /tmp/RtmpFkkeCQ/24104/pomp_4fc43714a7a9ebddf896bbc51635d211.c:5:
/tmp/RtmpFkkeCQ/24104/pomp_4fc43714a7a9ebddf896bbc51635d211.c: In function '__pomp_rmeasure':
/usr/local/apps/R/ubuntu_20.04/4.2.1/lib64/R/include/Rmath.h:333:16: error:
 too many arguments to function 'Rf_rnorm
In addition: Warning message:
In system2(command = R.home("bin/R"), args = c("CMD", "SHLIB", "-c",  :
  running command 'PKG_CPPFLAGS="-I'/home/kingaa/R/x86_64-pc-linux-gnu-library/4.2/pomp/include'
 -I'/home/kingaa/teach/sbied'" '/usr/local/apps/R/ubuntu_20.04/4.2.1/lib64/R/bin/R' CMD SHLIB -c
 -o /tmp/RtmpFkkeCQ/24104/pomp_4fc43714a7a9ebddf896bbc51635d211.so
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Question 5. Let V_n be a Markov process and let $W_n = h(V_n)$ for some function h. Which of the following statements are true?

(i) W_n is a Markov process for all choices of h.

(ii) W_n is a Markov process for some choices of h.

(iii) W_n is not a Markov process for any choice of h.

(iv) If $V_n = (X_n, Y_n)$ where X_n and Y_n are a POMP, and $h(X_n, Y_n) = X_n$ then W_n is a Markov process.

(v) If $V_n = (X_n, Y_n)$ where X_n and Y_n are a POMP, and $h(X_n, Y_n) = Y_n$ then W_n is a Markov process.

(A) i,iv,v

(B) ii,iv

(C) ii,v

(D) iii

(E) None of them