INSTRUCTIONS

- You have 1 hour to complete the exam.
- The exam is closed book, closed notes, closed computer, closed calculator, except one 8.5” × 11” cheat sheet of your own creation.
- Mark your answers **on the exam itself**. We will *not* grade answers written on scratch paper.

<table>
<thead>
<tr>
<th>Last name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First name</td>
<td></td>
</tr>
<tr>
<td>Student ID number</td>
<td></td>
</tr>
<tr>
<td>Instructional account (cs61a-)</td>
<td></td>
</tr>
<tr>
<td>BearFacts email (@berkeley.edu)</td>
<td></td>
</tr>
<tr>
<td>TA</td>
<td></td>
</tr>
<tr>
<td>Name of the person to your left</td>
<td></td>
</tr>
<tr>
<td>Name of the person to your right</td>
<td></td>
</tr>
</tbody>
</table>

*All the work on this exam is my own.* *(please sign)*
1. (10 points)  Send Help

```python
b = 5
def x(x, help):
    def send(help):
        print(help)
        return nope
    def nope(send):
        print(send)
        return help
    a = send(help)
def help():
    return x("help")
print("More")
return a

Expression | Interactive Output
---|---
print(print(print("hi"))) | hi
    None
    None

print((lambda x: print("which"))
    (print("is")), "first") | is
    which
    None first

a = print("hi")() | hi
    Error

b = a | Error

print(b) | 5

x = x(lambda x: print("oh dear"),
      print("which print")) | which print
    None
    More

x = x("almost") | almost

print(x()) | oh dear
    None
```
2. (10 points) Stuck In Lambda’s

Fill in the environment diagram that results from executing the code below until the entire program is finished, an error occurs, or all frames are filled. You may not need to use all of the spaces or frames.

A complete answer will:

- Add all missing names and parent annotations to all frames.
- Add all missing values created or referenced during execution.
- Show the return value for each local frame.

```python
x = lambda x: x
def f(g, h):
    x = lambda: True
    def y():
        if f():
            return 'a'
        else:
            return 'b'
    return g(y)
f |lambda h: h(), x

Global

f1: _______ [parent=_______]

f2: _______ [parent=_______]

f3: _______ [parent=_______]

f4: _______ [parent=_______]
```

Return Value
Frames | Objects
---|---
Global frame

```
4
```

```
f1: f

<table>
<thead>
<tr>
<th>g</th>
<th>h</th>
<th>x</th>
<th>y</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>λ(h)</td>
<td></td>
<td>λ()</td>
</tr>
<tr>
<td></td>
<td></td>
<td>λ(h)</td>
<td></td>
<td>λ()</td>
</tr>
</tbody>
</table>

Return value: "a"

```

```
λ <line 12>

<table>
<thead>
<tr>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>λ()</td>
</tr>
<tr>
<td>λ()</td>
</tr>
</tbody>
</table>

Return value: "a"

```

```
y [parent=f1]

<table>
<thead>
<tr>
<th>Return value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;a&quot;</td>
</tr>
</tbody>
</table>

```

```
λ <line 3> [parent=f1]

<table>
<thead>
<tr>
<th>Return value</th>
</tr>
</thead>
<tbody>
<tr>
<td>True</td>
</tr>
</tbody>
</table>

```
3. (10 points) Gib-me the Words!

Did you know that in Python, you can access elements in a string exactly like you access elements in a list? For example, if we were given the string, Gibbes:

(a) Assigning to the variable g, allows us to access the ‘G’ with g[0].
(b) Slicing and concatenation are valid: g[3:] + ‘t’ evaluates to ‘best’.

Write a function that follows the specs below by creating a list of words out of a string, where a word has no spaces (‘ ’). DO NOT USE LEN.

You may only use the lines provided. You may not use any Python built-in sorting functions.

```python
start, end, lst = 0, 0, []
for letter in s:
    if letter != ',':
        end += 1
    elif start == end:
        start, end = start + 1, end + 1
    else:
        lst += [s[start:end]]
        start, end = end + 1, end + 1
return lst
```
4. (10 points) Walt is Relevant

We have a list of numeric data points \( l \), and we want to see if a list of relevant numbers \( s \) is found in the data. The catch is, we want to see if the numbers in \( s \) occur in the same order within the data of \( l \), though not necessarily one after the other. If so, then \( s \) is a subsequence of \( l \).

Write a predicate function \( \text{subseq} \) that takes two lists \( l \) and \( s \) as arguments, and determines if \( s \) is a subsequence of \( l \). If so, the function should return True; otherwise, it should return False. We have provided a few doctests to demonstrate the definition and usage.

```python
if s == []:          
    return True
elif l == []:        
    return False
elif l[0] == s[0]:   
    return subsequence(l[1:], s[1:])
else:                
    return subsequence(l[1:], s)
```

5. (0 points) Games of Berkeley

In the box below, write a positive integer. The student who writes the lowest unique integer will receive one extra credit point. In other words, write the smallest positive integer that you think no one else will write.