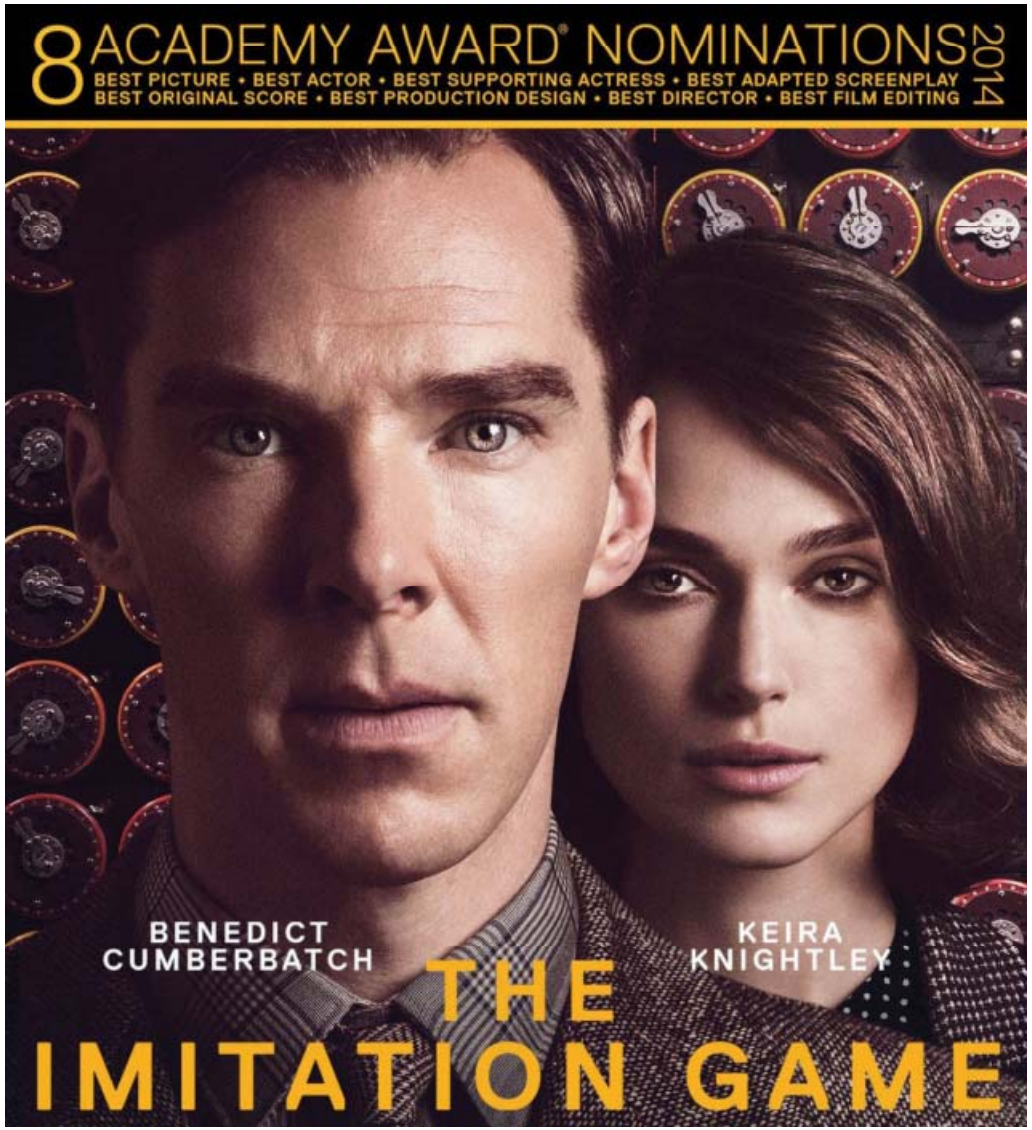
模仿遊戲

2014

班奈狄克·康柏拜區

綺拉·奈特莉



Enigma

恩尼格瑪

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德軍了不起的對稱式加密裝置

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來協助破解

- 1939 Alan Turing 沒有像電影裡製作那個機器
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- 在計畫幾乎被軍方停下的時候, Turing 在酒吧裡聽到那個 “女朋友” 故事時, 徹夜想到的密碼破解方法 – 我們現在稱為 **Known Plaintext Attack (已知明文攻擊)**, 如果知道每天某一時間一定會送出來的密文所對應的明文 (電影裡是 "Heil Hitler"), 破解相同鑰匙加密的密文的難度大幅度降低 (密鑰空間大幅縮小)

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  - 這個方法的精神在 80 年代搖身一變成為 定義密碼系統安全性 的基本方法, 一直沿用到現在

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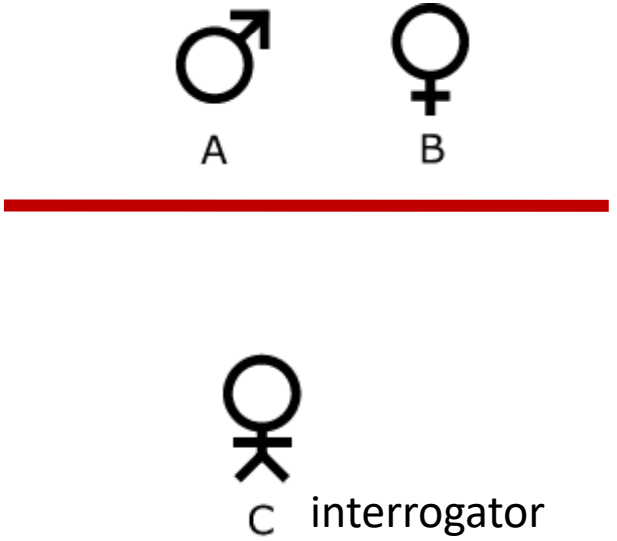

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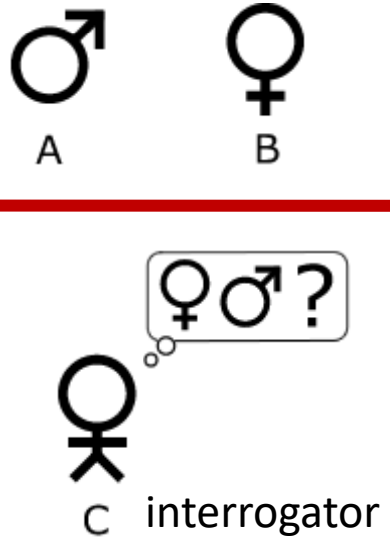

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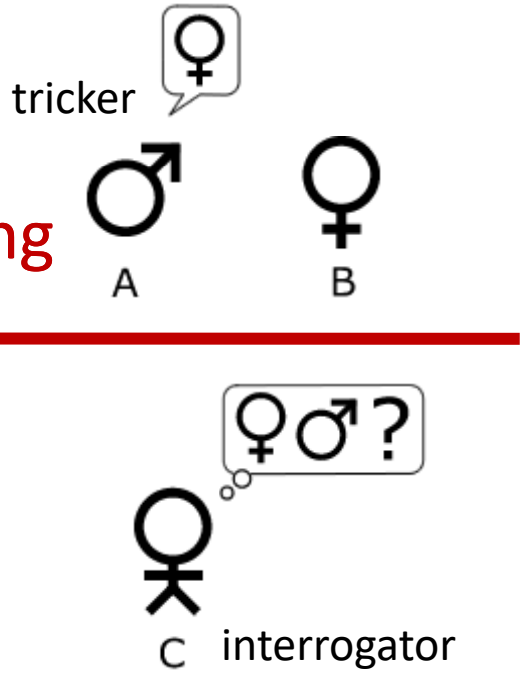

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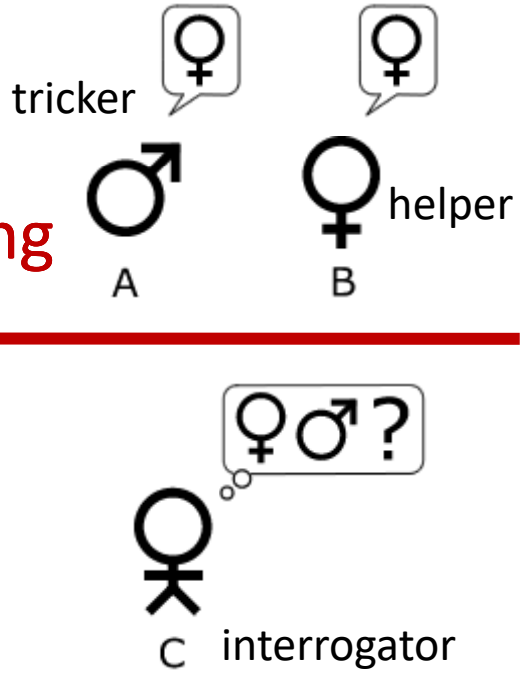

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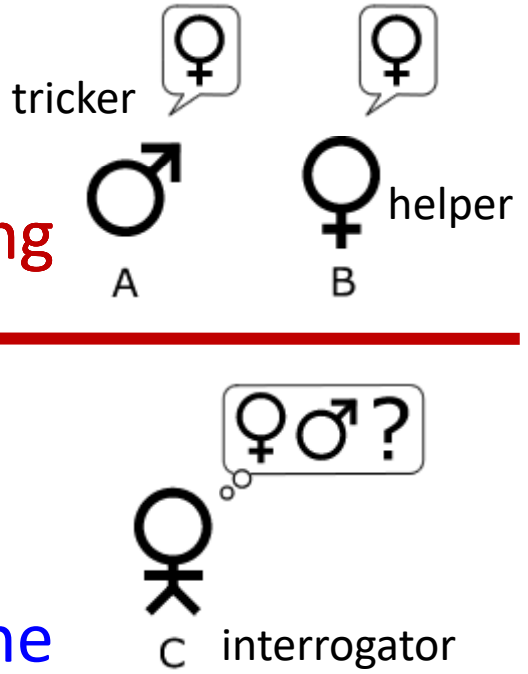
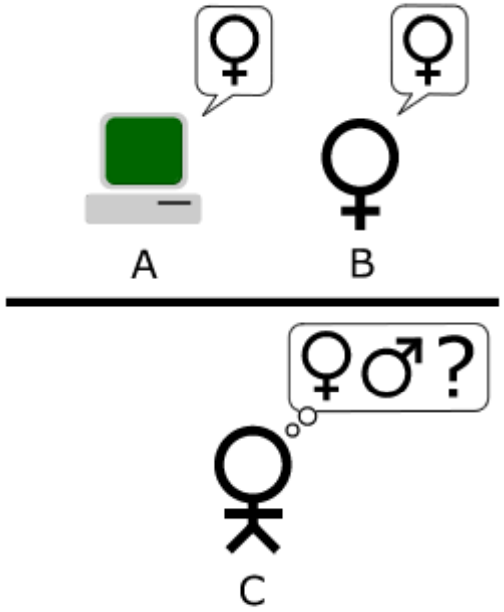


把 player A 換成機器



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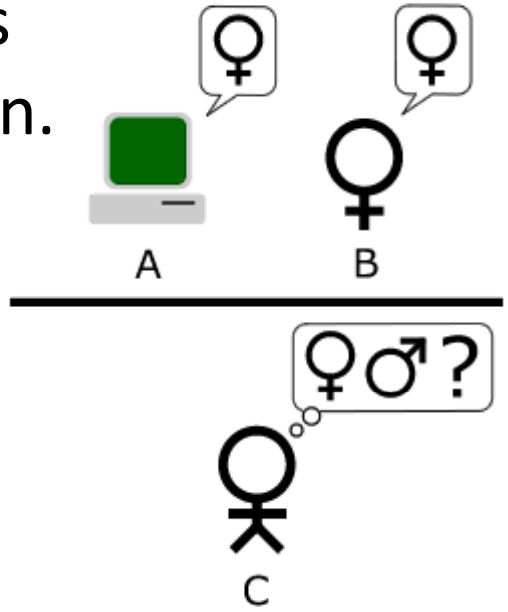

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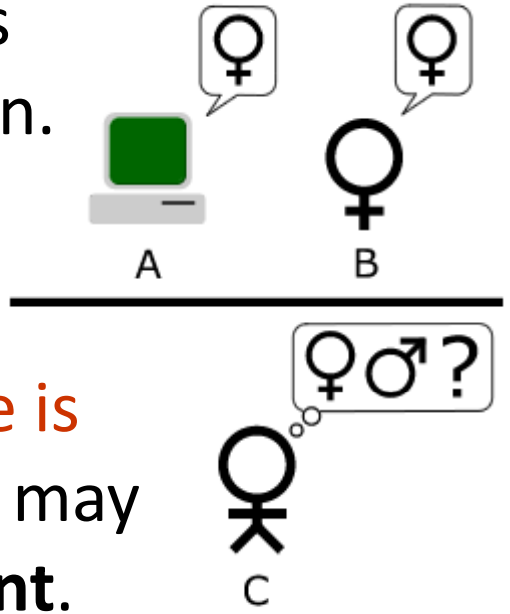

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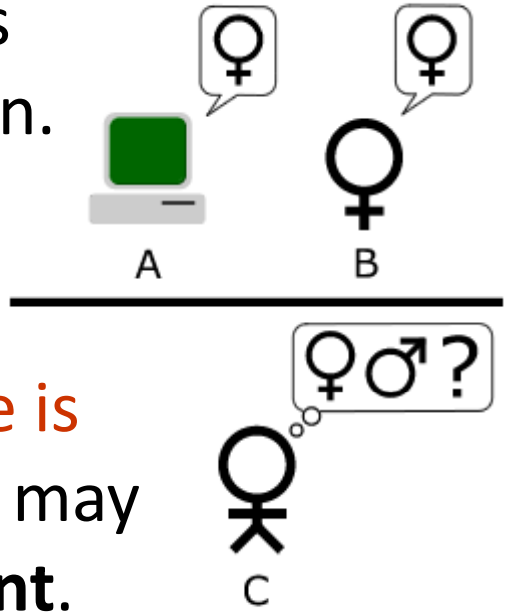

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- The test results do **not** depend on the machine's ability to give **correct answers** to questions, only **how closely** its answers resemble those a human would give.

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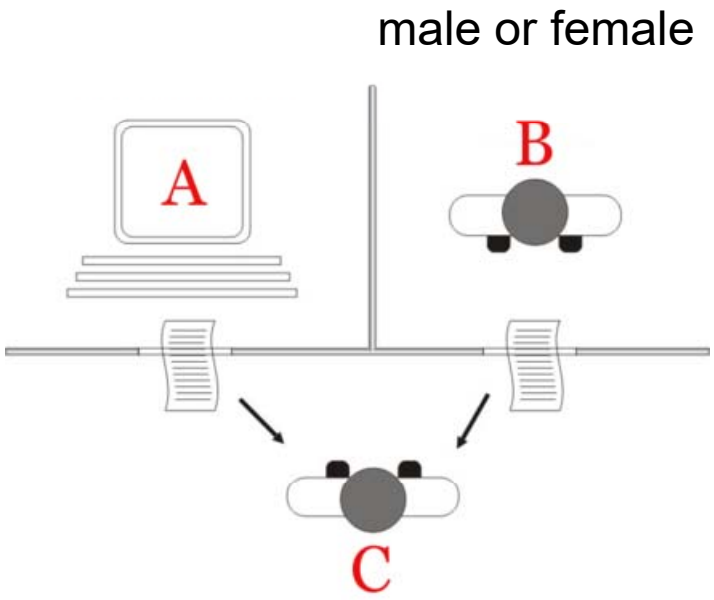
- The Turing test had been passed for the first time.

Standard Interpretation – Another Version



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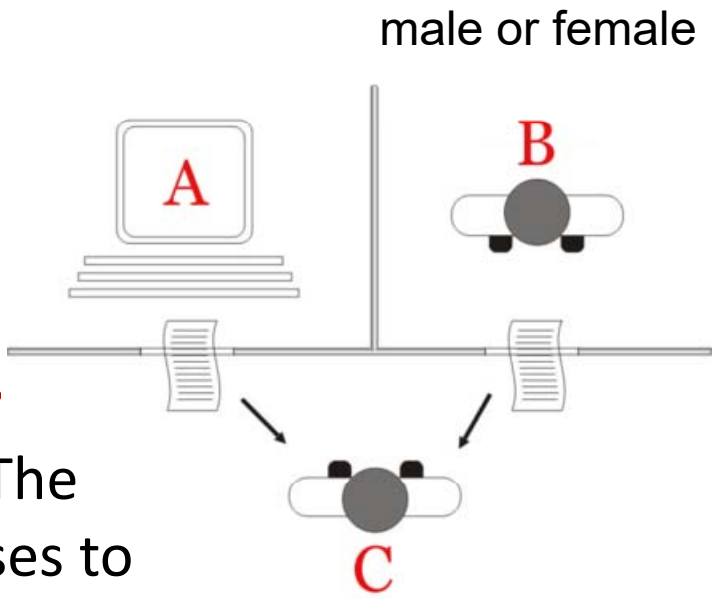

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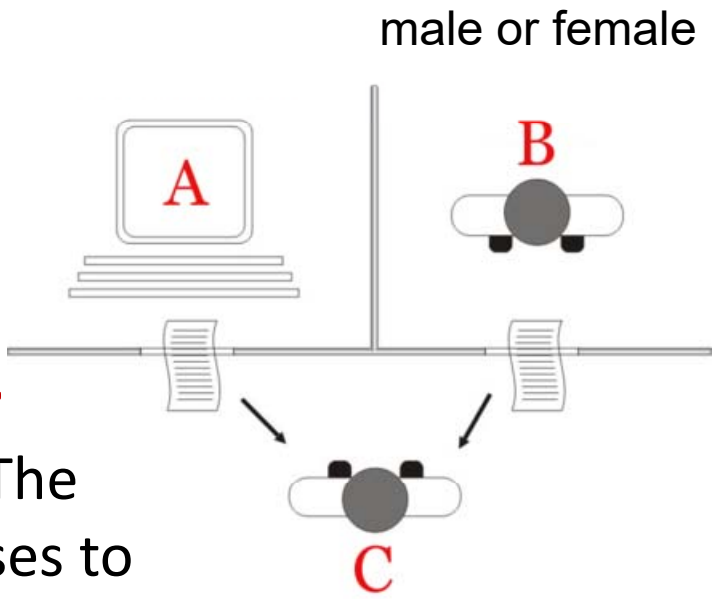

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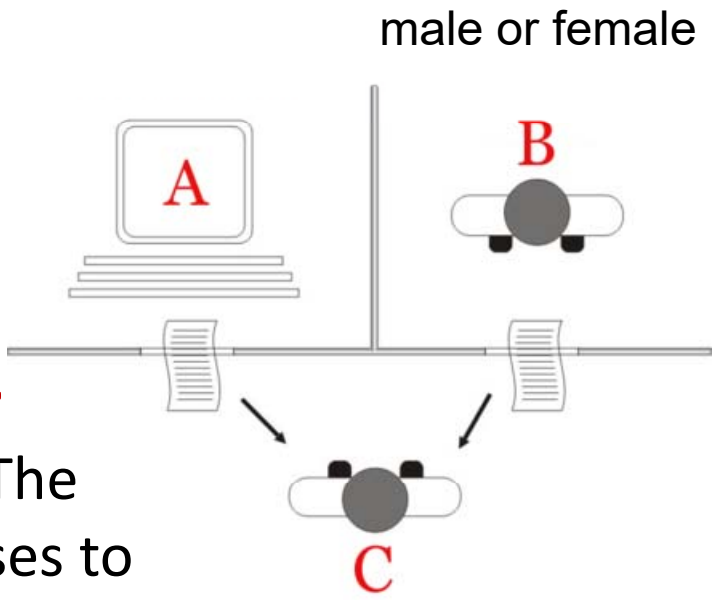

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- While there is some debate regarding whether the "Standard Interpretation" is that described by Turing or, instead, based on a misreading of his paper, these versions are **not** regarded as **equivalent**, and their strengths and weaknesses are distinct.

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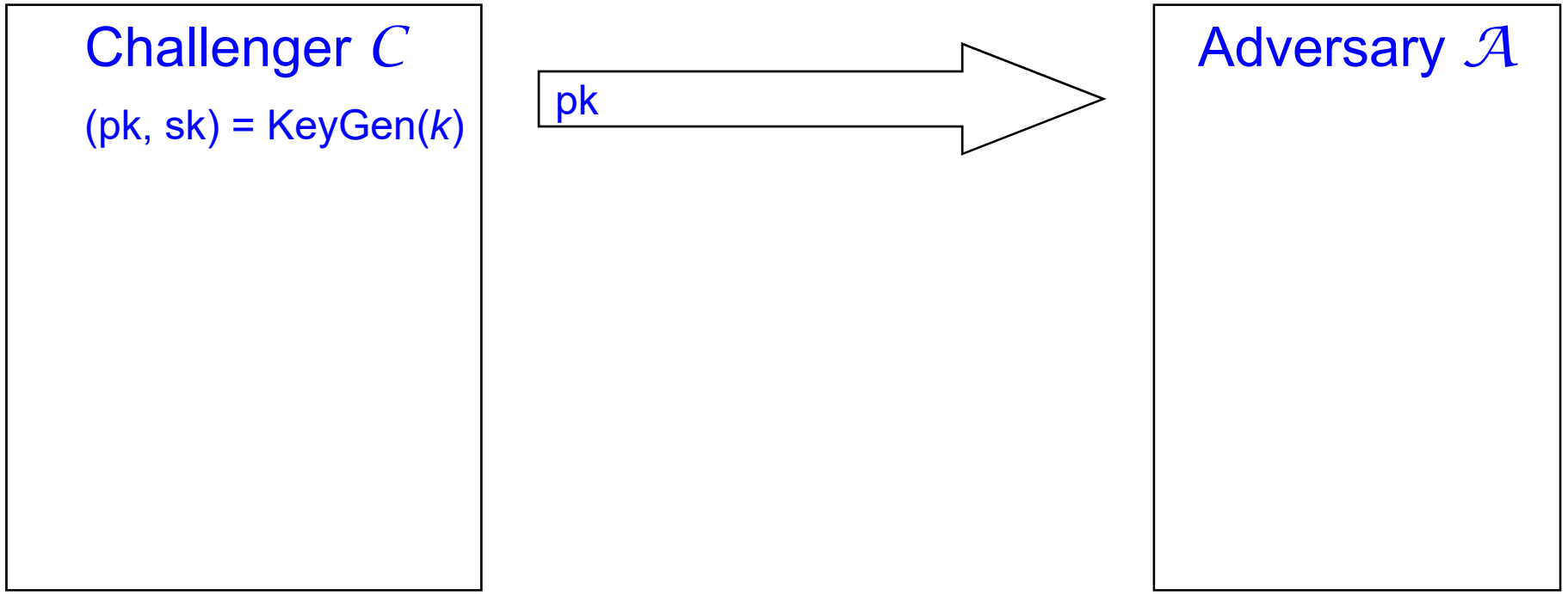

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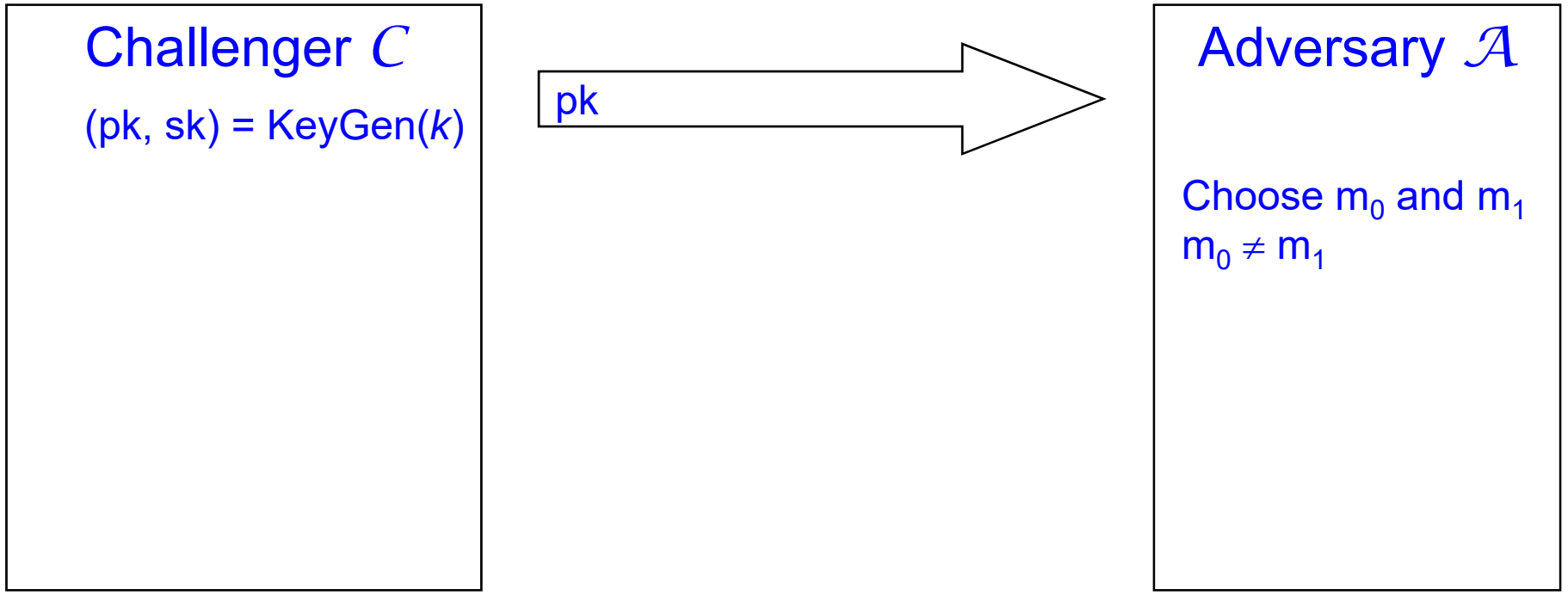

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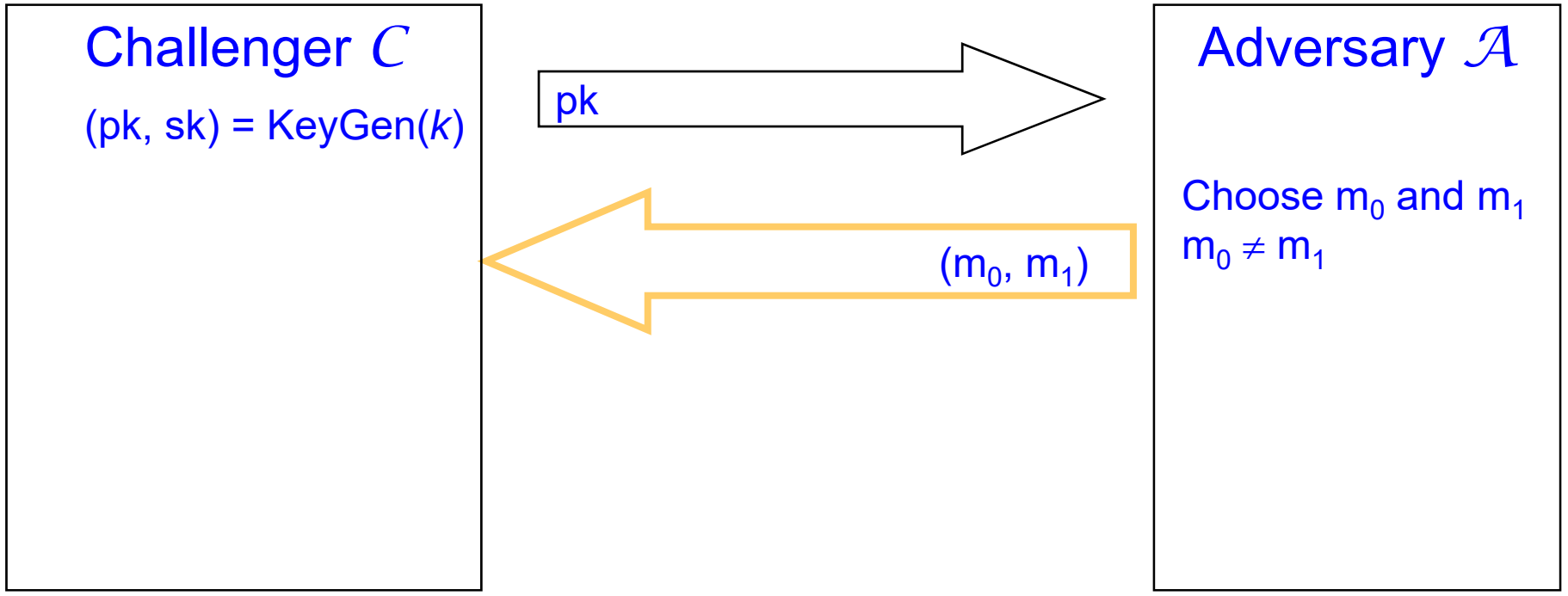

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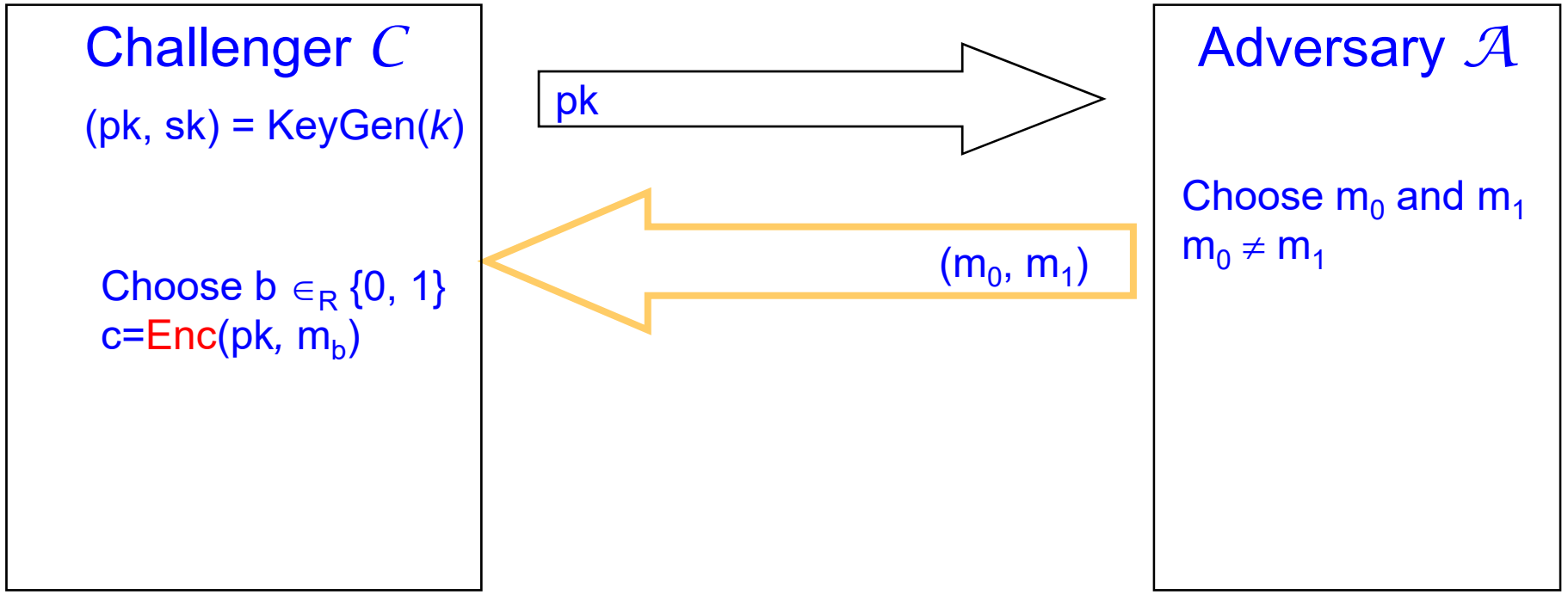

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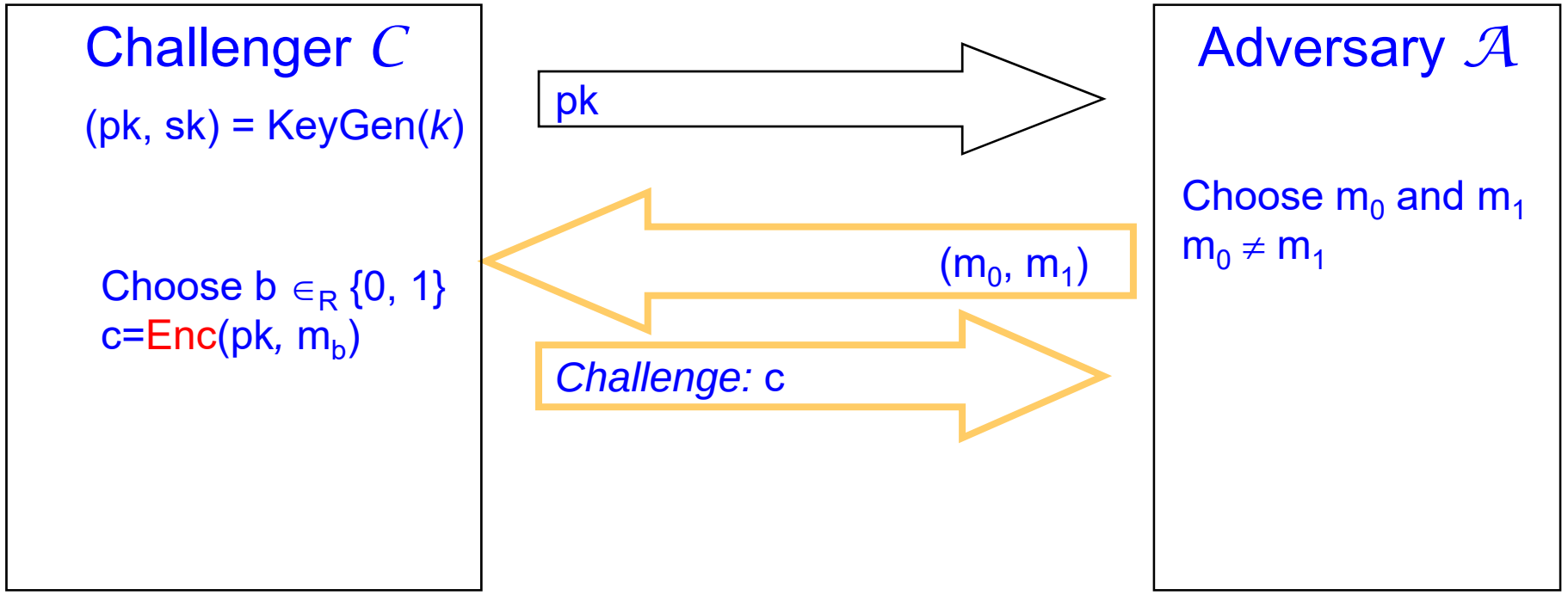

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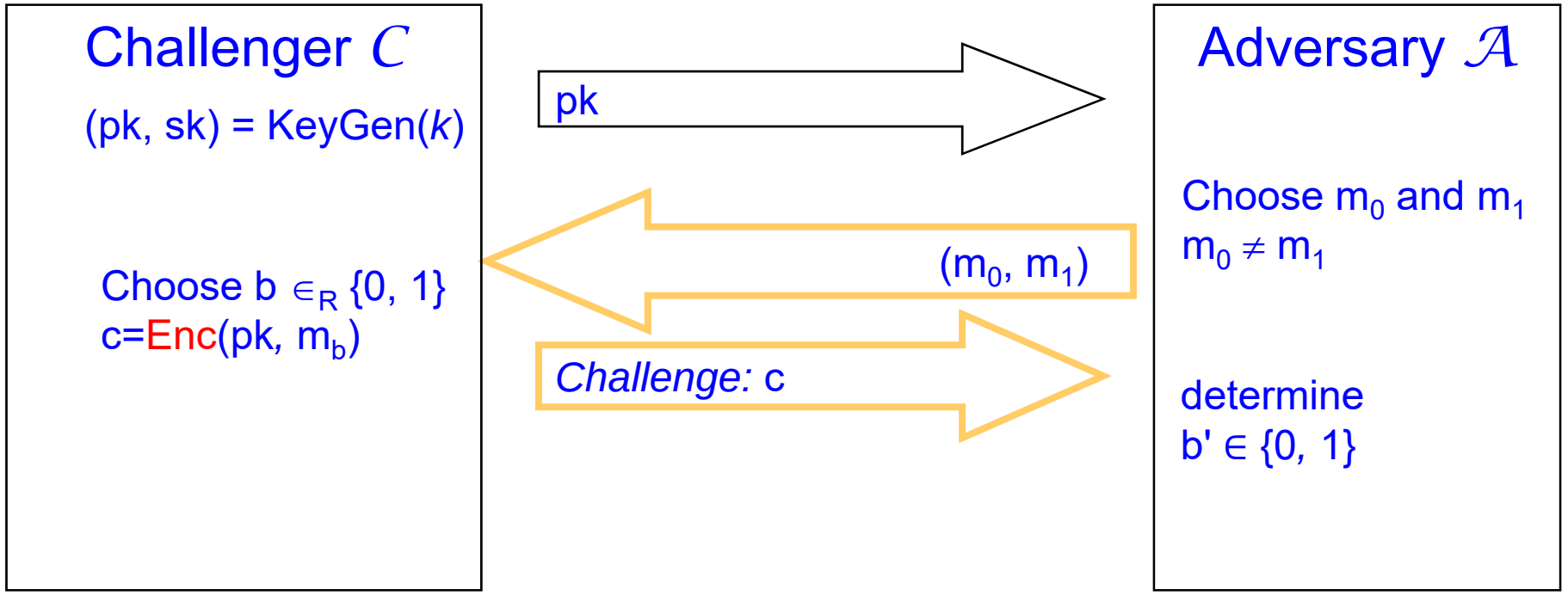

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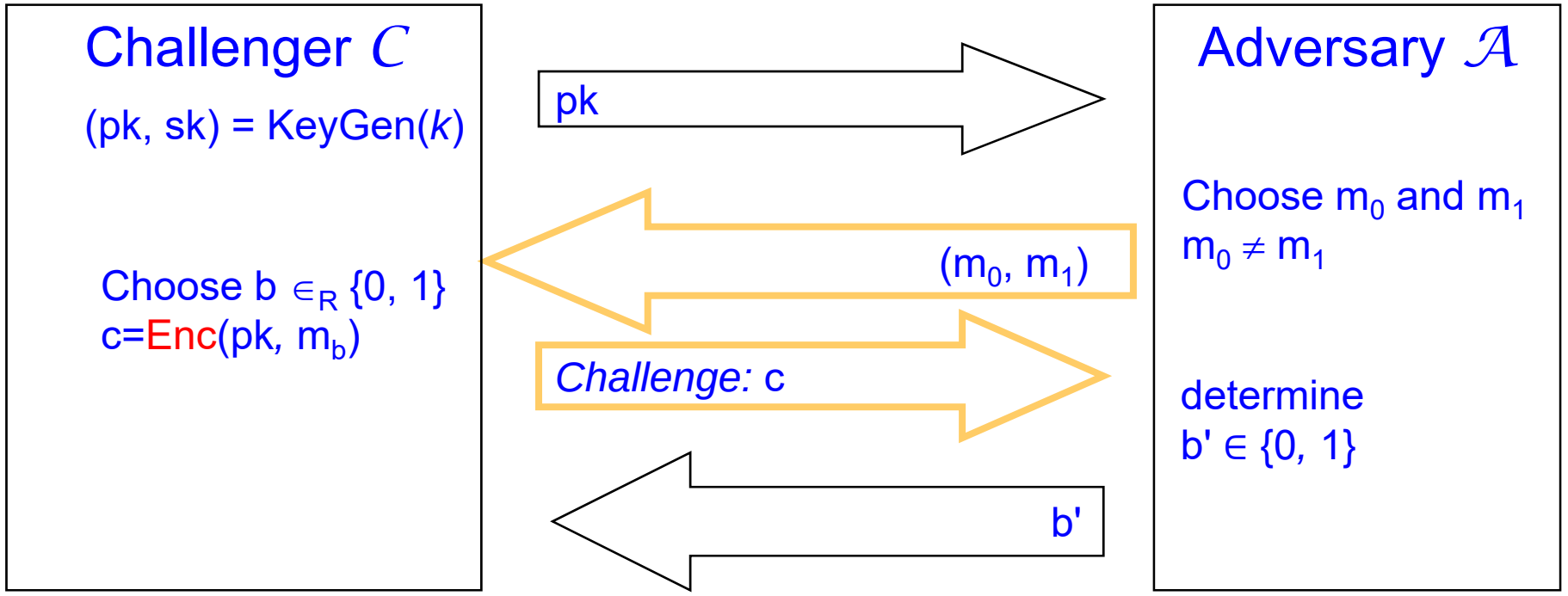

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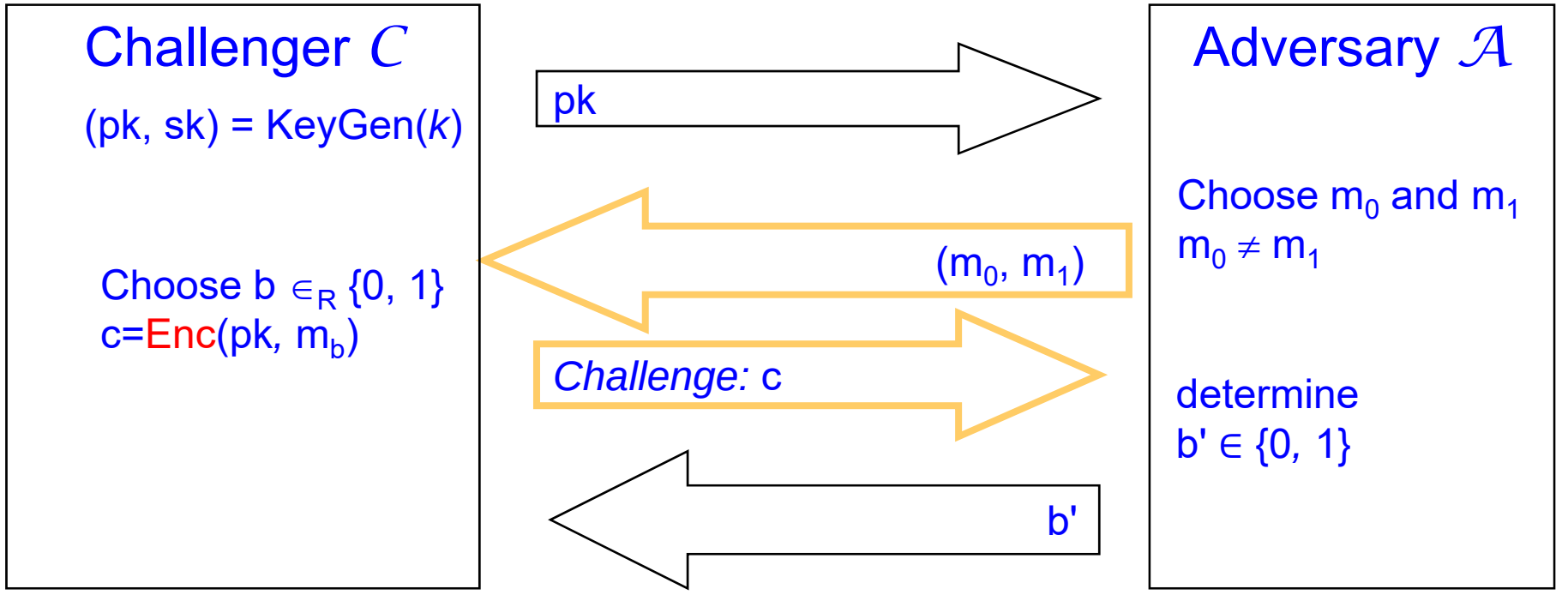

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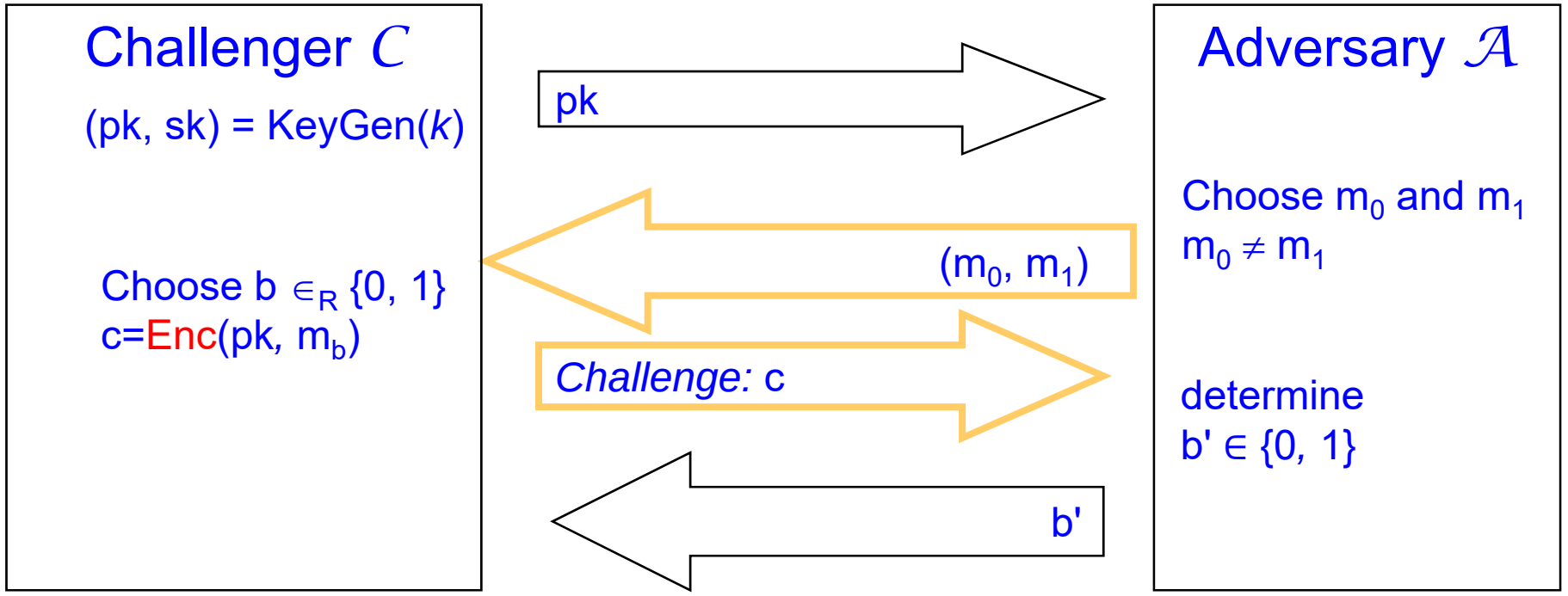

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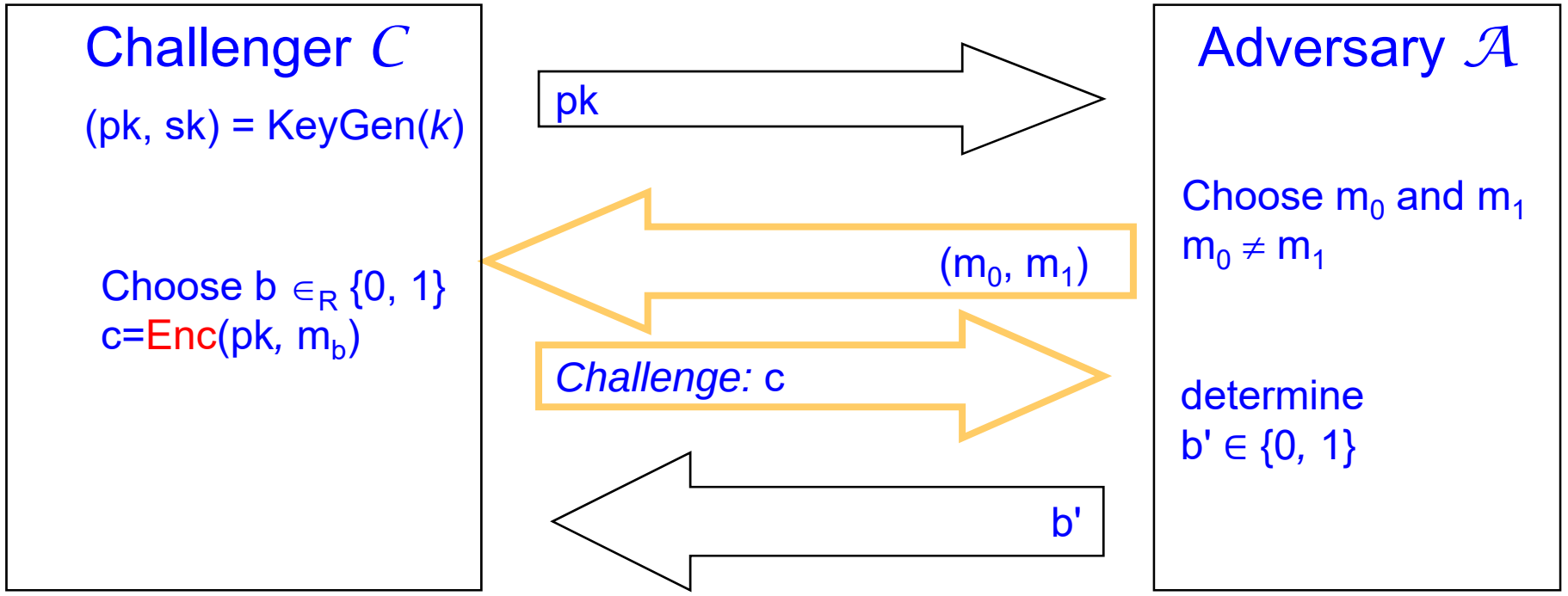

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Enc(·) is secure if $\text{Adv}_{\mathcal{A}}(k)$ is negligible

不可分辨性

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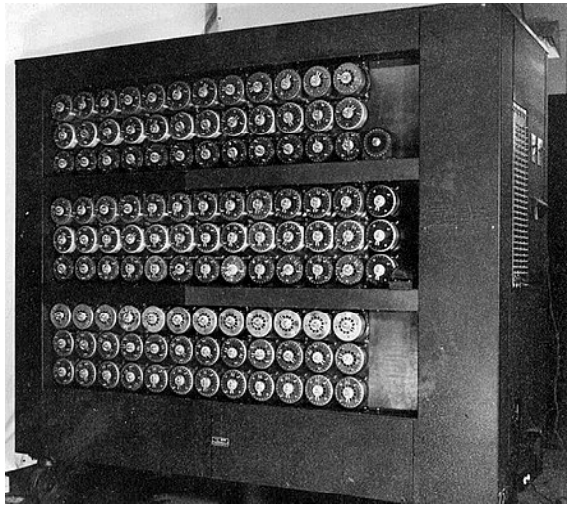

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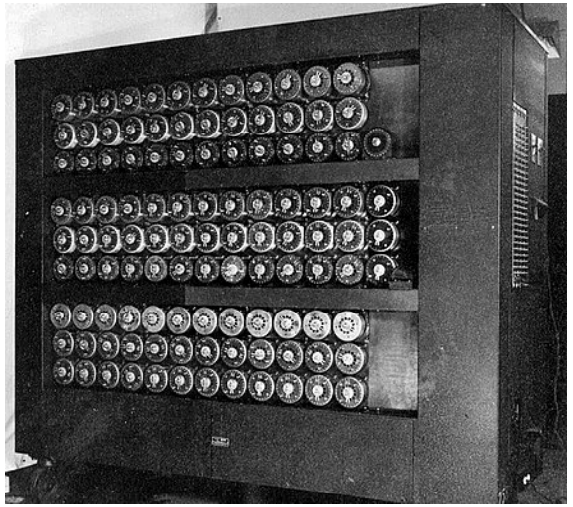

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- Bletchley Park Hut 6 最早在英倫空戰期間破譯了德國空軍的 Enigma，因為德國空軍對密碼疏於管理，讓 Bletchley Park 找到了很多人為漏洞來破譯密碼，其中就包括那個“女朋友”事件

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  - 電影裡所說德國電報員發送 CILLY 是根據真實事件改編的，這個事件發生在破譯德國空軍密碼工作中，德國空軍要求自己的電報員隨機選擇 3 個字母設置齒輪，再發送隨機選擇的 3 個字母幫助密文接受方將 Enigma 配置成相同設置來解碼。其中有個一個名為 **Wal**ter 的電報員，每天都將他的 Enigma 齒輪設置成他名字的前三個字母 W A L，然後發送的 3 個字母是他女朋友名字 **Kal**are 的前三個字母 K A L

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  - 人很難真正做到隨機，所以大家用了很多讓人能猜的 Enigma 設置，比如 LON 後面跟 DON，BER 後面跟 LIN，HIT 後面跟 LER 等

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- Heil Hitler 是一個 **crib**，在 Bletchley Park，他們用某些德語中的已知固定搭配或者已知信息作為解碼的 key，這些 key 叫 crib，因為 Enigma 被設計成對於任意相同的電文所輸出的密文不含有重複字元，所以可以用 crib 比對找出 crib 在電文中的可能位置來幫助破解當日的 Enigma 設置

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Known plaintext attack

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- 我們用的電腦不是 **Turing Machine**，Turing Machine 是一個理論上的計算模型，是有限狀態機的延伸：
  http://en.wikipedia.org/wiki/Turing_machine